COMPARISON OF DIFFERENT DOSES OF INTRATHECAL HYPERBARIC BUPIVACAINE IN COMBINED SPINAL EPIDURAL TECHNIQUE FOR ELECTIVE CAESAREAN SECTION

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DECLARATION

I hereby declare that the dissertation entitled **"COMPARISON OF DIFFERENT DOSES OF INTRATHECAL HYPERBARIC BUPIVACAINE IN COMBINED SPINAL EPIDURAL TECHNIQUE FOR ELECTIVE CAESAREAN SECTION"** has been prepared by me, under the Guidance of **Prof.Dr. S.Nellai Kumar, M.D.,D.A.,** Professor of Anaesthesiology, Govt. Kasturba Gandhi Hospital for Women & Children, Madras Medical College, Triplicane, Chennai, in partial fulfillment of the regulations for the award of the degree of M.D[Anaesthesiology], examination to be held in April 2013.

This study was conducted at Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai.

I have not submitted this dissertation previously to any university for the award of any degree or diploma.

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CERTIFICATE

This is to certify that the dissertation entitled, "**COMPARISON OF DIFFERENT DOSES OF INTRATHECAL HYPERBARIC BUPIVACAINE IN COMBINED SPINAL EPIDURAL TECHNIQUE FOR ELECTIVE CAESAREAN SECTION**" submitted by **Dr.N. SUDHAGAR**, in partial fulfilment for the award of the degree of Doctor of Medicine in Anaesthesiology by the Tamilnadu Dr. M.G.R. Medical University, Chennai is a bonafide record of the work done by him, in the INSTITUTE OF ANAESTHESIOLOGY & CRITICAL CARE, Madras Medical College, during the academic year 2010-2013.

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ABBREVIATIONS

Inj.:	-	Injection
i.v:	-	intravenous
i.e :	-	that is
eg:	-	Example
G:	-	Gauge
%:	-	percentage
mg :	-	milligram
Kg:	-	kilogram
ml:	-	millilitre
B.P:	-	Blood Pressure
SpO_2:	-	Oxygen saturation of arterial blood
ECG:	-	Electrocardiogram
NIBP:	-	Non Invasive Blood Pressure
H.R:	-	Heart Rate
SBP:	-	Systolic Blood Pressure
DBP:	-	Diastolic Blood Pressure
MAP:	-	Mean Arterial Pressure
CVS:	-	Cardiovascular System
CNS:	-	Central Nervous System
ASA PS:	-	American Society of Anaesthesiologist Physical Status
min:	-	minutes
SD:	-	Standard Deviation
wt:	-	weight
Ht:	-	Height
NA	-	Neonatal Apgar
EPH	-	Ephedrine
cm	-	centimetre

COMP	-	complications
MR	-	Muscle Relaxation
PS	-	Patient Satisfaction
GA	-	Gestational Age
OC	-	Obstetric Code
IND	-	Indication
2% LIG	-	2% Lignocaine
DUR	-	Duration of surgery

CONTENTS

1.	INTRODUCTION	1
2.	AIM OF THE STUDY	3
3.	COMBINED SPINAL EPIDURAL ANALGESIA	4
4.	PREGNANCY AND REGIONAL ANAESTHESIA	13
5.	PHARMACOLOGY OF BUPIVACAINE	15
6.	PHARMACOLOGY OF LIGNOCAINE	20
7.	REVIEW OF LITERATURE	25
8.	MATERIALS AND METHODS	36
9.	OBSERVATION AND RESULTS	49
10.	DISCUSSION	64
11.	SUMMARY	73
12.	CONCLUSION	75
13.	BIBLIOGRAPHY	
14.	ANNEXURES	

INTRODUCTION

The use of neuraxial anaesthesia has gained popularity in recent time over general anaesthesia for caesarean section. Neuraxial anaesthesia has several advantages, including a reduced risk of failed intubation and aspiration of gastric contents, avoidance of depressant drugs and the mother can remain awake and enjoy the birthing experience[1,2]. It has been found that blood loss is reduced under regional anaesthesia for caesarean section[3].

The combined spinal-epidural technique(CSE), first reported in cesarean section in 1984[4], has recently gained popularity. Spinal anaesthesia has a very rapid onset of action and provides a dense neural blockade but finite duration of action and the drawbacks are, that they carry a high incidence of nausea, vomiting, hypotension[5] and even fetal acidemia. Epidural anaesthesia is more titratable, may produce less hemodynamic swings[6], can be used for postoperative analgesia but slow onset, patchy blockade, catheter migration, large volume of local anaesthetic requirement are the drawbacks.

CSE offers benefits of both spinal and epidural anaesthesia and decreases their failure rates when used alone. Both techniques have a failure rate of 2-5% even with experienced practitioners[6], when used separately. The chance of both techniques failing at the same time, if combined, would be 0.16%.

CSE is shown to produce a physiologically denser block than either technique performed separately[7].

CSE technique allows the use of smaller doses of local anaesthetics, which in turn reduces the incidence of high spinal block and hypotension[8].

This study was designed to evaluate the optimum dose of intrathecal hyperbaric bupivacaine 0.5% with epidural lignocaine in combined spinal epidural technique for caesarean section that can produce adequate anaesthesia without causing significant hemodynamic changes.

AIM OF THE STUDY

This study aims to evaluate the optimum dose of intrathecal hyperbaric bupivacaine with epidural lignocaine in combined spinal epidural technique for caesarean section to achieve adequate anaesthesia with hemodynamic stability.

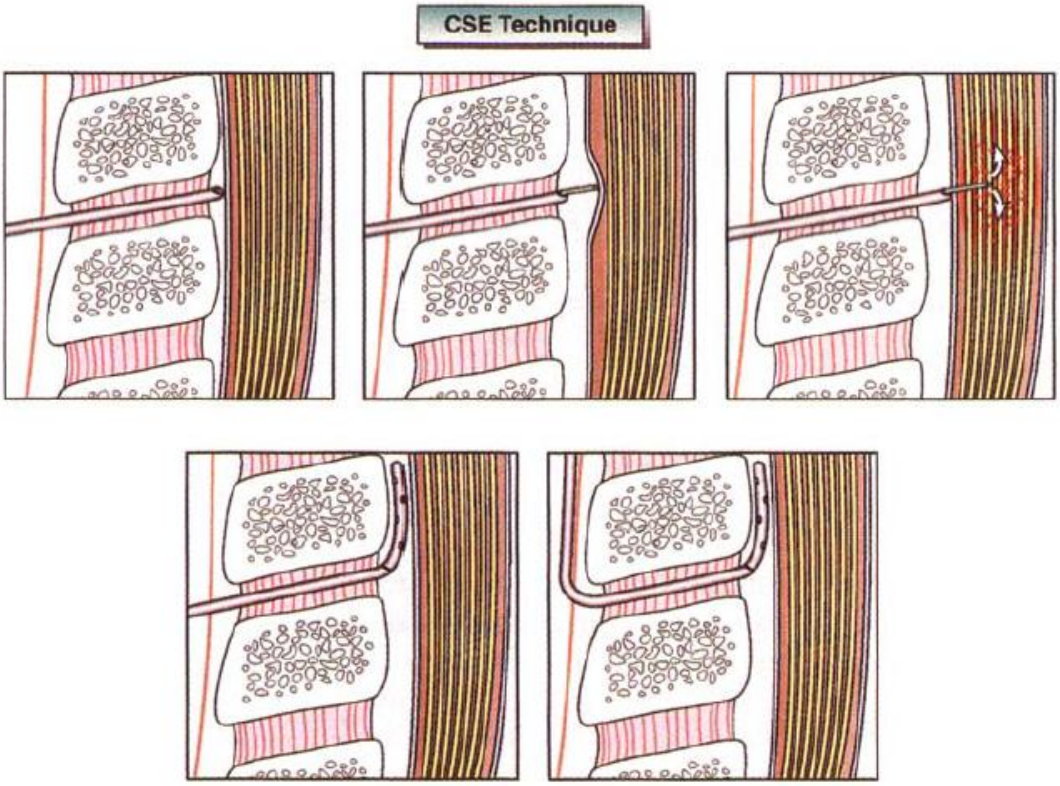
COMBINED SPINAL EPIDURAL ANALGESIA

Combined spinal-epidural (CSE) technique for providing pain relief for labor and anaesthesia for caesarean section has gained popularity. It involves the identification of the epidural space and insertion of the epidural catheter and an initial placement of an intrathecal dose of local anaesthetic, opioid or both, everything as a single procedure[9].

It combines the advantages of rapid onset and the reliability of blockade obtained by subarachnoid blockade with the flexibility given by the epidural catheter placed and avoids the disadvantages, when used seperately[10].

HISTORY:

- **Soresi** was the first person to perform Combined Spinal Epidural technique in 1937.
- **Cerelaru** used separate spaces for each component in 1979
- **Brownridge** in 1981 advised the use of CSE in caesarean section.
- **Carrie** in 1984 described needle thru needle technique.
- **Dr**. **Morgan** in 1993 introduced CSEA(combined spinal epidural analgesia) for labor – walking epidurals.



The combined spinal epidural technique.

Typically, an epidural needle is inserted in the epidural space *(top left)* and a spinal needle is inserted through it *(top middle).* Because of the presence of air in the epidural space, the pencil-point spinal needle may deform the dura considerably before puncturing it *(top right).* After injection through the spinal needle, it is withdrawn, an epidural catheter is inserted *(bottom left),* and the epidural needle is withdrawn *(bottom rigbt).*

EQUIPMENT:

EPIDURAL NEEDLE:

- Tuohy needle with bent tip – 16G or 18G, 8cm/10cm long shaft.

- Epidural catheter – 16G or 18G catheter with single hole at the end or closed end with side holes at multiple levels. A 0.2 micrometer filter at proximal end to prevent contamination by bacteria and injection of particulate matter thru the catheter.

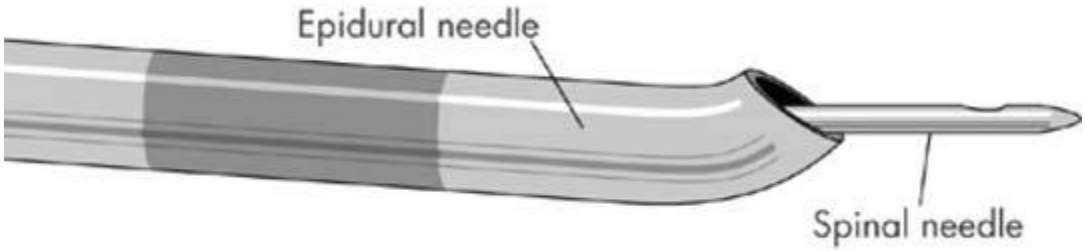
SPINAL NEEDLE:

- Fine gauge needles (24G -27G) with a pencil point tip (sprotte or whitacre)

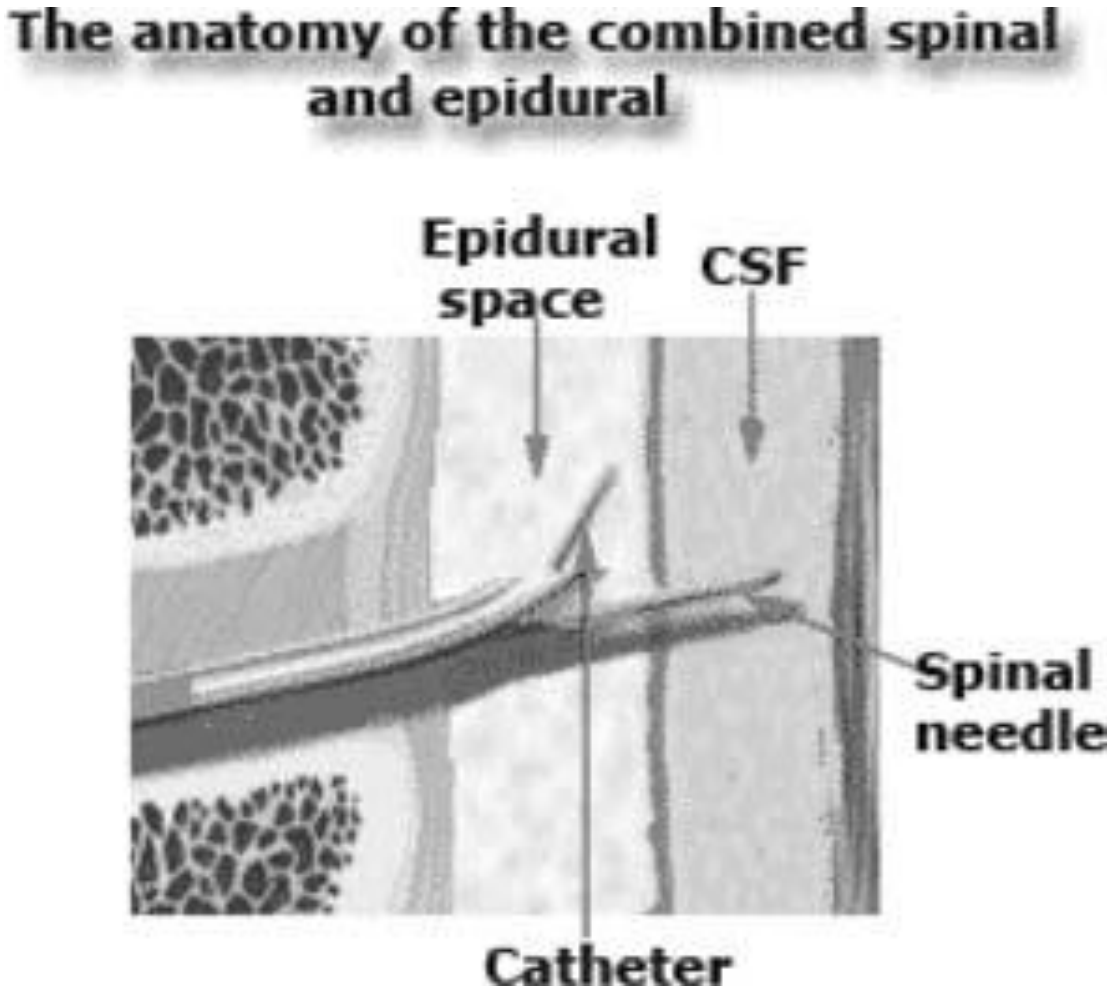
  8cm tuohy needle – 120 mm spinal needle

  10cm tuohy needle – 150 mm spinal needle

- Spinal needle protrusion of 1.7cm beyond the epidural needle is considered optimal.



COMBINED SPINAL EPIDURAL NEEDLE



CSE TECHNIQUES:

1. **SINGLE PASS:**

- **Soresi** in 1931

- Needle introduced into the epidural space and a dose of local anaesthetic is injected and the needle further introduced into the subarachnoid space where further dose of local anaethetic is deposited.

- Not used nowadays

- No longevity of the block

2. **NEEDLE THROUGH NEEDLE:**

16G or 18G epidural needle is used to identify the epidural space. Spinal needle of size 24G to 27G is then introduced via the epidural needle, till dural piercement is felt. Spinal needle stylet is then removed. Cerebrospinal fluid needs to be visualized in the hub of the spinal needle. Injection of local anaesthetic agent is done. Spinal needle is taken out, leaving the epidural needle in situ. About 3.5cm of the epidural catheter is placed in the epidural space. Epidural catheter secured with sterile tapes and used to prolong pain relief once the spinal anesthesia worns off.

3. **NEEDLE THROUGH NEEDLE (BACKEYE+):**

Epidural needles, with backeye on the curve, specially designed for allowing spinal needle introduction in a straight line, tip coming out through the backeye, entering the subarachnoid space. The epidural catheter then travels along the curved part of the epidural needle and the tip is positioned cephalad.

4. **LOCKING NEEDLE THROUGH NEEDLE:**

It has locking device to stabilize the spinal needle with the epidural needle, after identifying the epidural space, which provides stability to the spinal needle.

5. **SEPARATE NEEDLES THROUGH SEPARATE INTERSPACES:**

Epidural catheter and spinal needle are introduced separately at two different interspaces. Possibility of catheter injury by the spinal needle tip cannot be ruled out.

6. **SEPARATE NEEDLES THROUGH SAME INTERSPACES:**

Epidural catheter is placed first followed by spinal needle insertion and then the subarachnoid drug administration. Provides good patient satisfaction.

7. **COMBINED NEEDLE:**

This avoids the friction, supposed to occur while using needle through needle technique and separates the epidural and spinal components.

8. **DUAL CATHETER TECHNIQUE:**

Spinal and epidural catheterization can be done seperately. They have the possibility of catheter entanglement, cauda equine syndrome and accidental subarachnoid injection of high volume of drugs, mistaking spinal for epidural catheter, that might result in total spinal anaesthesia.

SPINAL ANAESTHESIA ALONE

ADVANTAGES:

- Rapid onset
- High reliability than epidural
- Dose requirement reduced, prevents toxicity
- End point of needle placement is definite.

DISADVANTAGES:

- No top-up facilities available to prolong the blockade
- As dura is deliberately breached, the risk of postdural puncture headache is high.

EPIDURAL ANAESTHESIA ALONE

ADVANTAGES:

- Used widely
- Familiarity of the technique
- Epidural catheter allows topup doses to produce alteration or prolongation of the blockade
- Hypotension occurs slowly when compared to subarachanoid blockade.
- Postdural puncture headache is uncommon, unless accidental dural puncture occurs.

DISADVANTAGES:

- Slow onset
- Sometimes asymmetrical or patchy
- Huge volume of local anaesthetic agents needed
- Certain nerve roots are very difficult to block

COMBINED SPINAL EPIDURAL ANAESTHESIA CAN THUS PRODUCE…

- Rapid induction of anaesthesia
- The quality of pain relief is better
- Low dose of local anaesthesia required
- Epidural catheter can prolong and optimize spinal block

COMPLICATIONS OF CSE TECHNIQUE:

- Technically difficult
- Extensive blockade

  This may be due to

  - Bolus of epidural local anaesthetic agent on the spinal component
  - The transfer of epidural drugs across the dural membrane
  - accidental migration of epidural catheter tip into the intrathecal space

  - epidural bolus of anesthetic agent can extend intrathecally administered drug, only while the subarachanoid blockade is developing (13 minutes)

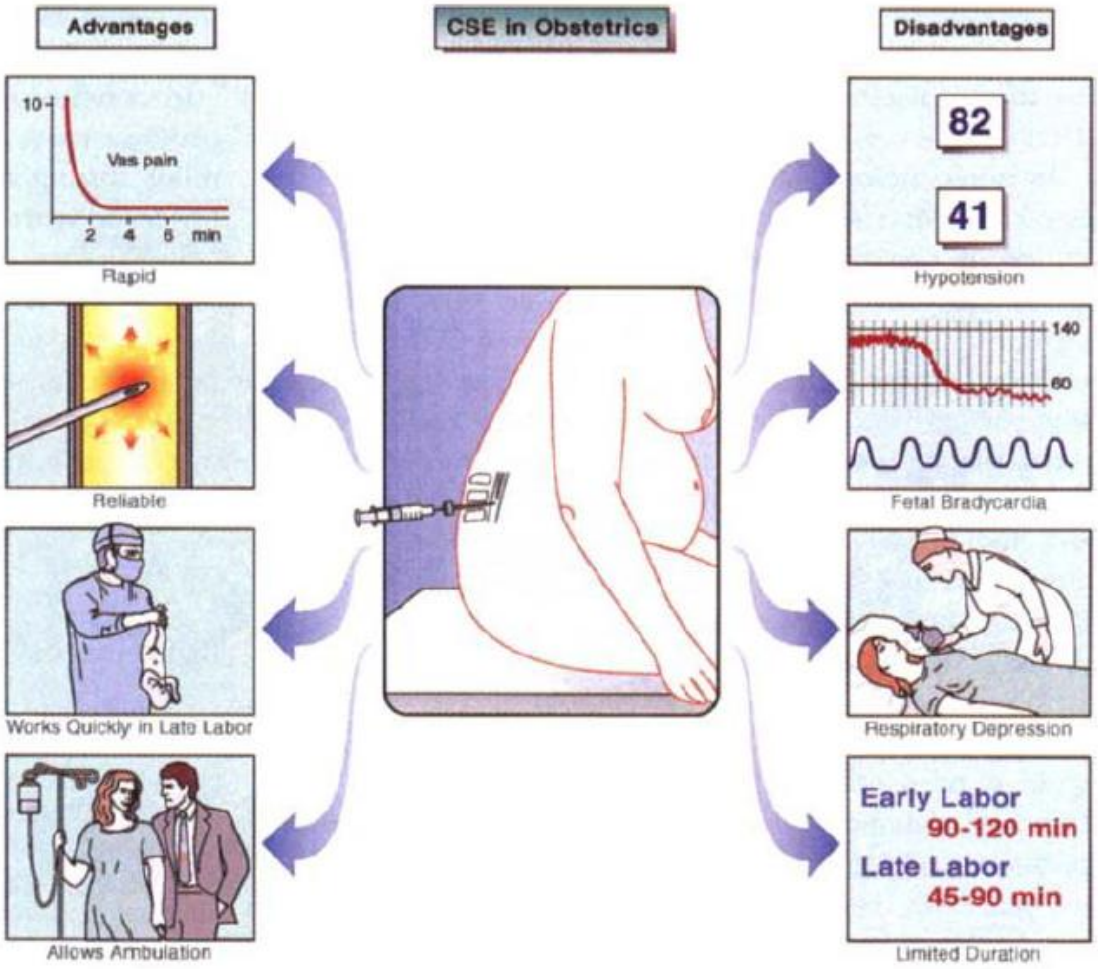
- Postdural puncture headache
- Meningitis
- Neurological sequele rare

PREGNANCY AND REGIONAL ANAESTHESIA

EFFECTS OF PREGNANCY ON SPINAL ANAESTHESIA

TECHNICAL CONSIDERATIONS

- Enhancement of lumbar lordosis causes reduced vertebral inter-spinous gap creating technical difficulty.
- Widening of pelvis results in a head down tilt, when a parturient is in the lateral position. This may increase the rostral subarachnoid spread of hyperbaric solution when injection is made with patient in the lateral position.
- Apex of thoracic kyphosis is at a higher level, thus increasing the cephalad spread of local anaesthetic.



CSE IN OBSTETRICS

EFFECT OF PREGNANCY ON SPINAL ANAESTHETIC DOSE REQUIREMENTS

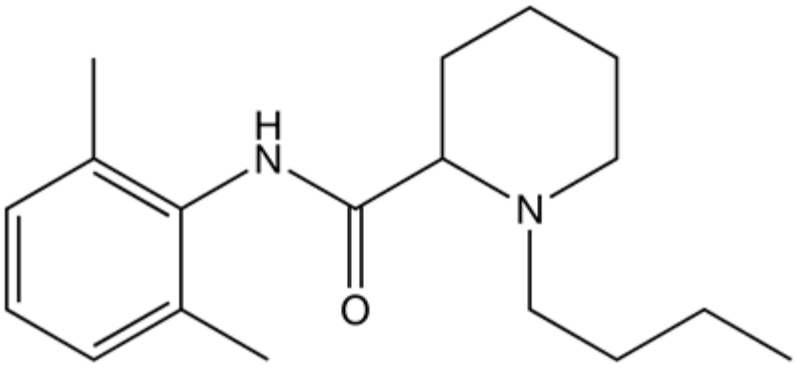
Pregnancy enhances the spread of hyperbaric local anaesthetic solution in the subarachnoid space resulting in 25% reduction in the segmental dose requirement. This decrease is attributed to following factors:

- Reduction of spinal cerebrospinal fluid volume, which accompanies distension of vertebral venous plexus.
- Enhanced neural susceptibility to local anaesthetics.
- Inward displacement of intervertebral foraminal soft tissue, resulting from increased abdominal pressure
- Increased rostral spread caused by the widening of pelvis.
- Higher level of the apex of thoracic kyphosis during late pregnancy.

PHARMACOLOGY OF BUPIVACAINE

Bupivacaine is an amide local anaesthetic agent. It belongs to the homologous series of n-alkyl substituted pipecholyl xylidines. It was first synthesized by **Ekenstam** in 1957 and was used clinically in 1963. It is produced for clinical use as a racemic mixture containing both 'S' and 'R' forms in equal proportion. It is supplied as a hydrochloride salt.

CHEMICAL STRUCTURE:



1-butyl-n-(2,6-dimethyl phenyl) -2-piperidine decarboxamide hydrochloride monohydrate.

PHYSIO-CHEMICAL PROFILE[11]:

Molecular weight	-	288
pKa	-	8.1
Plasma protein binding	-	95%
Partition coefficient	-	28 (lipid solubility)
T ½	-	210 min
Clearance	-	8.3 l/min

MECHANISM OF ACTION:

Like all the other local anaesthetics, it inhibits Na channels. It decreases or prevents large transient increase in permeability of the cell membranes to Na ions that follows depolarization of the membrane and thereby blocks the nerve conduction. It also reduces the permeability of the resting nerve membrane to potassium ions as well as sodium ions and hence has got a stabilising action on all excitable membranes.

EFFECTS:

- Local – nerve blockade
- Regional – pain, temperature, touch, motor power and vasomotor tone supplied by the nerves are blocked.
- Systemic – effects due to systemic absorption or accidental intravenous administration.

It is 4 times more potent than lignocaine but the onset of action is slower. The duration of action is longer. Sensory block is more marked than the motor block.

SYSTEMIC EFFECTS:

CNS:

Can produce

- Circumoral numbness, metallic taste
- Tinnitus, light headedness, dizziness
- Confusion, slurred speech
- convulsions

CVS:

- depresses automaticity and contractility of the heart
- slows conduction of cardiac action potential as prolongation of PR and QR intervals on ECG.
- Re-entrant phenomenon and ventricular arrhythmias
- Results mostly from high lipid solubility
- R-enantiomer is more toxic than S-enantiomer
- Pregnancy increases cardiotoxic effects of bupivacaine

KINETICS:

- Rapidly absorbed from the site of injection
- Peak systemic concentration – 5 to 30 minutes after administration
- Duration of action – 360 to 720 minutes
- Metabolism in liver – dealkylation to pipecoloxylidine, aromatic hydroxylation
- Excretion – 5% by kidney as unchanged drug and rest as metabolites

PREPARATION:

- 0.25%, 0.5% solutions in 10, 20 ml vials, respectively
- 5mg/ml (0.5%) bupivacaine with 80 mg dextrose (to increase baricity) in 4 ml ampoules for subarachnoid injection (baricity – 1.0207)

USES:

- Central neuraxial blocks
- For local infiltration subcutaneously
- Peripheral nerve blockade

CONTRAINDICATIONS:

- Known hypersensitivity to amide local anaesthetics
- Intravenous regional anaesthesia(IVRA)

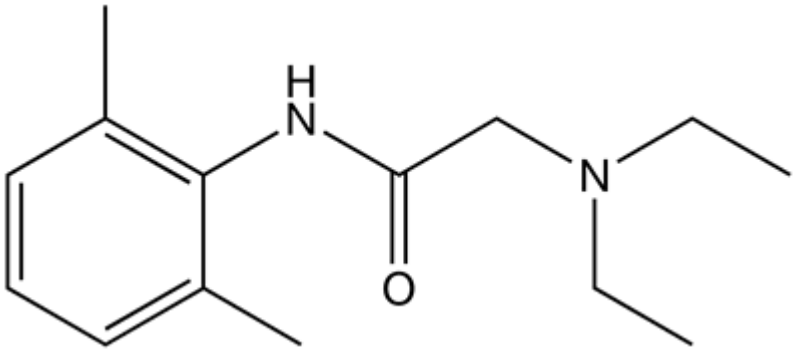
MAXIMAL DOSE:

2.5 mg/kg body weight and the strength used is 0.25 – 0.75% with or without adrenaline (1:200000 or 1:400000)[11]. Adrenaline does not prolong its effect, but reduces its toxicity

PHARMACOLOGY OF LIGNOCAINE

Lignocaine is the most commonly used local anaesthetic agent. It is a tertiary amide and was first synthesised in 1943 in Sweden. It was first used by **Gordh** in 1948[11].

CHEMICAL STRUCTURE:



PHYSIO-CHEMICAL PROFILE:

Molecular weight	-	234
pKa	-	7.9
Plasma protein binding	-	64%
Partition coefficient	-	2.9 (lipid solubility)
T ½	-	96 min
Clearance	-	12.6 l/min

MECHANISM OF ACTION:

Like all the other local anaesthetics, it inhibits Na channels. It decreases or prevents large transient increase in permeability of the cell membranes to Na ions that follows depolarization of the membrane and thereby blocks the nerve conduction.

EFFECTS:

- Local – nerve blockade
- Regional – pain, temperature, touch, motor power and vasomotor tone supplied by the nerves are blocked.
- Systemic – effects due to systemic absorption or accidental intravenous administration.

SYSTEMIC EFFECTS:

CNS:

Low plasma concentration produces numbness of tongue and circumoral area. As plasma concentration increases, it produces restlessness, vertigo, tinnitus followed by drowsiness before seizure occurs. Seizures are followed by CNS depression, which may be accompanied by hypotension and apnea.

CVS:

A therapeutic concentration 1.5 – 6 microgram/ml of lignocaine can produce the following effects

- Depression of slow spontaneous depolarization, suppresses automaticity without affecting the conduction velocity. Automaticity induced by stretch, hypoxia or catecholamines can also by suppressed by lignocaine.

- Shortening of action potential period and effective refractory period of purkinjee and ventricular cells. Thus it has got stabilizing effect on the heart.

KINETICS:

IV injection – t ½ - 7 to 10 mins within the first hour, due to rapid distribution into various tissues. After the initial phase, the t ½ is 90-120 mins. Absorption is slow in regional anaesthesia[11].

METABOLISM AND EXCRETION:

The principle metabolic pathway is oxidative dealkylation in the liver to monoethylglycine xylidine then to xylidine. Monoethylglycine xylidine has approximately 80% of the action of lignocaine protecting against cardiac arrhythmias. This has prolonged elimination half life. Xylidine has approximately 10% of the activity of lignocaine.

PREPARATION:

- 0.5% for infiltration with epinephrine 1:200000 to 1:400000
- 4% for topical analgesia, in surgery of throat, larynx, pharynx etc.
- For nerve block and extradural block 1.5-2% with epinephrine
- For corneal analgesia 4% - this causes no mydriasis, vasoconstriction or cycloplegia
- For urethral analgesia 1-2% jelly
- For tracheal tube 5% as an ointment

USES:

- Central neuraxial blocks
- For local infiltration subcutaneously
- Peripheral nerve blockade

CONTRAINDICATIONS:

- Known hypersensitivity to amide local anaesthetics

REVIEW OF LITERATURE

1. **Shou-Zen Fan et al**[12] have compared four different doses of intrathecal hyperbaric bupivacaine combined with epidural lignocaine for caesarean section. A total of 80 parturients were taken into the study. They were divided into four groups by random allocation. Depending on the group to which they belong, they received 0.5ml, 1ml, 1.5ml or 2ml of 0.5% bupivacaine intrathecally. Sensory level of blockade was checked every 3 minutes till 15 minutes. If Thoracic level-4(T4) sensory blockade was not achieved by 15 minutes, epidural 2% lignocaine was supplemented by increments of 3ml every 3 minutes, till T4 level was achieved. The results were analysed on the basis of the intial level of sensory blockade achieved, epidural requirements, complications like vomiting, shivering, dyspnea etc. They have concluded that injecting 5 mg of hyperbaric bupivacaine intrathecally combined with epidural lidocaine can provide an effective and rapid onset of anaesthesia for caesarean section with minimal adverse effects.

2. **Ranasinghe J S et al**[6] conducted a retrospective study to evaluate the significance of combined spinal epidural technique for cesarean deliveries. The study reviewed cesarean deliveries that were done under CSE technique, in their institution over 6 months. Successful CSE was defined as the absence of administering general anesthesia to the parturients during cesarean delivery. 99.4% success rate was observed for CSE technique. They have concluded that combined spinal epidural anaesthesia was a great improvement to single shot spinal or continuous epidural anaesthesia by providing reliable and safe regional anaesthesia for the parturients undergoing caesarean delivery.

3. **Roofthooft E et al**[13] studied the effect of low dose intrathecal bupivacaine in reducing the incidence of maternal hypotension and providing adequate anesthesia for cesarean delivery. Intrathecal bupivacaine of about 5 to 7mg provided adequate anesthesia for cesarean deliveries. They have concluded that low dose spinal anaesthesia as a part of combined spinal-epidural technique is a very valuable tool in improving maternal and fetal outcome during anaesthesia for caesarean section.

4. **Leo S et al**[14] studied the effects of using low-dose intrathecal bupivacaine in Combined spinal epidural method for cesarean section. 60 parturients, who were posted for elective cesarean section, were randomized to three groups. Hyperbaric bupivacaine of 7mg, 8mg and 9mg was deposited intrathecally for parturients in group 7, 8 and 9 respectively. All parturients, irrespective of their group, received morphine 100mcg intrathecally and Hydroxy ethyl starch of 15ml/kg given intravenously while starting the CSE technique. When sensory level blockade of T4 was reached, surgery was allowed to start. The clinical outcomes were monitored and recorded. In their study, they have concluded that lowest dose of spinal bupivacaine (7mg) provided equally rapid onset and effective anaesthesia for caesarean section while reducing the occurrence of hypotension when compared with 8 and 9 mg.

5. **Choi D H et al**[15] compared combined spinal-epidural with epidural anaesthesia for cesarean delivery. 64 parturients posted for elective cesarean delivery were randomly dividen into two groups. CSEA group received 1.5 to 1.6 cc of 0.5% bupivacaine heavy intrathecally, which was followed by 10 cc of 0.5% bupivacaine plain epidurally, 10 minutes after the intrathecal injection. EA group had 20 to 25 cc of 2% lignocaine along with fentanyl 100mg, 0.1 cc of 0.1% epinephrine and 8.4% NaHCO3 1.5 cc. the two groups were compared based on the anesthetic quality, intraop and postop problems. Intraop analgesia, motor blockade and good muscle relaxation were better with CSEA group than the EA group. They have concluded that, when combining the main spinal and the supporting epidural anaesthesia, CSEA achieves greater efficacy and less side effects than the pH adjusted epidural anaesthesia in caesarean delivery.

6. **Titti thoren et al**[16] compared sequential combined spinal-epidural anesthesia with spinal anesthetic technique for cesarean delivery. 42 patients posted for cesarean delivery were randomly assigned into two group. First group received spinal anesthesia 12.5mg of 0.5% bupivacaine intrathecally. Second group received 7.5mg of 0.5% bupivacaine intrathecally and additional dose of epidural 2% lignocaine was administered, if necessary, to get a sensory block level of T4. The time taken, from the starting of regional technique to the initiation of surgery and till the time of delivery, was noted. They have found that the sequential CSE technique was proved to be safe and as effective as spinal anaesthesia for caesarean delivery. There is a risk of hypotension with both the techniques, although it is more precipitous after conventional spinal anaesthesia.

7. **Marc Van De Velde et al**[17] studied the effects of different doses of spinal hyperbaric bupivacaine on maternal hemodynamic changes in the combined spinal epidural anesthetic technique. 50 parturients undergoing cesarean delivery were randomly allocated into two groups. The first group received 9.5mg of 0.5% bupivacaine with 25 mcg sufentanyl. The second group received 6.5mg of 0.5% bupivacaine with 25 mcg sufentanyl intrathecally. Various outcomes visual analogue scoring, hemodynamic changes, etc., were monitored and recorded. They have concluded that small dose spinal anaesthesia with bupivacaine (6.5mg) along with sufentanil (25 microg) better maintains the patient's hemodynamics, in addition to providing adequate anaesthesia.

8. **Ben David B et al**[18] studied the effects of low dosage of bupivacaine along with fentanyl as an adjuvant intrathecally for cesarean section. 32 parturients posted for cesarean section were divided randomly into two groups. First group received 10 mg of 0.5% plain bupivacaine intrathecally and the second group received 5 mg of 0.5% plain bupivacaine along with 25 mcg of fentanyl.

Intraop hemodynamics, the need for the inotropes/vasopressors and certain other parameters were monitored and recorded. They have concluded that bupivacaine 5 mg with fentanyl 25 microg provided adequate spinal anaesthesia for cesarean section with less incidence of hypotension, vasopressor need and nausea than spinal anaesthesia with 10mg bupivacaine.

9. **Langesaeter E et al**[19] compared low dose and high dose spinal anaesthesia along with phenylephrine infusion for cesarean deliveries. Eighty parturients, who were posted for elective cesarean section, were divided into four groups. First group received 7mg of 0.5% bupivacaine intrathecally and the second group received the same along with low infusion of phenylephrine(0.25mcg/kg/min). Third group received 10mg of 0.5% bupivacaine intrathecally and the fourth group received the same along with low infusion of phenylephrine(0.25mcg/kg/min). All patients received 4mcg of sufentanyl, in addition, intrathecally. Hemodynamics were monitored and recorded. They have found that low dose bupivacaine along with an infusion of phenylephrine and adequate co-hydration preserves the hemodynamics better during spinal anaesthesia for cesarean section.

10. **Beale N et al**[20] studied the effects of the epidural volume extension on the intrathecally administered drug during cesarean section. They have estimated the ED50 of intrathecal bupivacaine along with 25 mcg fentanyl for cesarean section to be 6.1mg and at such doses, Epidural Volume Extension(EVE) doesn't seem to produce reliable reductions in dosing along with intrathecal bupivacaine.

11. **Farida Ithnin et al**[21] compared the level of blockade produced by Combined spinal-epidural technique with the single shot spinal technique. Thirty women posted for elective cesarean section were randomly allotted into two groups. Both the groups received 2cc of 0.5% bupivacaine intrathecally. In CSE group, the epidural space was identified by loss of resistance technique using 2cc of air and the epidural catheter was not placed. The maximum sensory blockade achieved in both the groups were noted and compared. It was found that CSE technique without epidural catheterisation or administration of epidural drug resulted in a significantly higher sensory blockade level than the single shot spinal technique when the same amount of local anaesthetic agent was used intrathecally.

12. **Danelli G et al**[22] underwent a study to evaluate the lowest adequate dose of intrathecal hyperbaric bupivacaine for cesarean delivery. 24 parturients posted for elective cesarean delivery received CSE anesthesia. The intrathecal dose of hyperbaric bupivacaine was based on the height of the patient. Initially, for the first patient, 0.075mg/cm height of 0.5% bupivacaine was given intrathecally. When the sensory block level of T4 was achieved, the dosage for the next patient was reduced by 0.01mg/cm height. They showed that 0.06mg/cm height was the dose of intrathecal hyperbaric bupivacaine that provides good spinal anesthesia in 95% of the parturients posted for cesarean section.

13. **Subedi A et al**[23] studied the effects of the height and weight on intrathecal bupivacaine for cesarean delivery. 100 women posted for elective cesarean delivery were randomly allocated into two groups. First group received the adjusted dose of intrathecal bupivacaine according to the height and weight of patients using Harten's dose chart that was created from Caucasian parturients and the second group received 2.2ml of 0.5% hyperbaric bupivacaine intrathecally.

The time for achieving T5 sensory block level, hemodynamic variables, neonatal outcome and certain other parameters were observed and noted. They have found that the dose adjustment significantly decreased the bupivacaine dosage with an added advantage of less incidence of hypotension and good neonatal outcome.

14. **Sivevski A et al**[24] studied the effects of low dose of intrathecal hyperbaric bupivacaine along with fentanyl for cesarean deliveries. 40 parturients posted for elective cesarean delivery, were randomly allocated into two groups. The first group received 13.5mg of plain bupivacaine 0.5%. The second group received 9mg of isobaric bupivacaine 0.5% with 25 mcg fentanyl intrathecally. Hypotension, surgical relaxation and certain other parameters were monitored and recorded. Though sensory blockade and motor blockade were very intense with the plain bupivacaine group, the incidence of hypotension and vomiting were also very high in this group, when compared to the bupivacaine-fentanyl group. So, they concluded that bupivacaine 9 mg along with 20 mcg fentanyl produced adequate spinal anesthesia for cesarean section with less incidence of hypotension and vasopressor need while ensuring excellent surgical anesthesia.

15. **Vanhelder T et al**[25] studied the role of CSE in managing parturients with valvular heart defects. They have presented a case of successful anaesthetic management of a parturient with moderate mitral stenosis and aortic insufficiency. They have concluded that carefully planned regional (CSEA) anaesthetic technique was safely used both for labor and caesarean section in pregnant patients with valvular heart disease..

MATERIALS AND METHODS

This study was conducted at the Govt. Kasturba Gandhi Hospital for Women & Children, Madras Medical College, Triplicane, Chennai-5, between January 2012 to March 2012 on 80 patients of ASA physical status I and II posted for elective caesarean section.

This study was started after ethical committee approval and after obtaining written informed consent from all the patients involved in this study.

STUDY DESIGN:

Prospective, randomized, double blinded study.

GROUPS:

The patients were divided randomly into four groups and each group containing 20 patients

GROUP A:

Patients in this group received 0.5ml of 0.5% hyperbaric bupivacaine intrathecally.

GROUP B:

Patients in this group received 1 ml of 0.5% hyperbaric bupivacaine intrathecally.

GROUP C:

Patients in this group received 1.5ml of 0.5% hyperbaric bupivacaine intrathecally.

GROUP D:

Patients in this group received 2 ml of 0.5% hyperbaric bupivacaine intrathecally.

SELECTION OF CASES

INCLUSION CRITERIA:

- Age : 18 years and above
- Weight : BMI < 30 Kg/m2
- Height : >145 cm
- Surgery : Elective
- American Society of Anaesthesiologist Physical Status (ASA PS) : I & II
- Who have given valid informed consent

EXCLUSION CRITERIA:

- Not satisfying inclusion criteria.
- Patients posted for emergency surgery
- Lack of written informed consent
- If the epidural catheter failed to thread through the tuohy needle or the procedure took more than 15 mins
- Abnormal coagulation profile/local sepsis or any other contraindication for spinal/epidural anaesthesia

PRE-ANAESTHETIC EVALUATION:

Patients selected for the study are evaluated thoroughly, which involved

- **HISTORY**
  - Of underlying medical illness/co-morbidity
  - Previous surgeries in the past
  - Last oral intake
  - Any drug allergies

- **PHYSICAL EXAMINATION**
  - General condition
  - Height
  - Weight
  - Vital signs – BP, PR, SpO2
  - Systemic examination – CVS, RS, CNS, abdomen, spine and cranium
  - Airwary assessment

- **INVESTIGATIONS**

  - Hemoglobin concentration
  - Complete blood count
  - Renal function test
    - blood urea
    - serum creatinine
    - serum electrolytes
  - Blood sugar
  - Urine routine
    - Albumin
    - Sugar
    - deposits
  - Bleeding time, clotting time
  - Blood grouping and typing
  - Electrocardiogram

* Patients satisfying inclusion criteria were explained about the procedure and the nature of the study.

* Written informed consent obtained from all the patients in their own language.

PREPARATION OF THE PATIENT:

After assessing the patient, an intravenous line started under aseptic precautions with 18 G cannula in the assessment room. Premedication given with Inj. Ranitidine 50mg and Inj. Metacloperamide 10mg IV, half an hour before surgery.

Patient shifted to operation theatre in left lateral position. Preloading was done with 20ml/kg of ringer Lactate over 15 minutes. Baseline pulse rate, blood pressure, arterial oxygen saturation(SpO2), respiratory rate and fetal heart sounds were noted.

EQUIPMENTS:

The spinal tray (autoclaved) used for performing the combined spinal epidural technique contained the following equipments.

1. Graduated 2ml syringe
2. No. 22G hypodermic needle
3. No. 18G hypodermic needle
4. No. 25G spinal needle – Quincke
5. No. 18G epidural needle
6. No. 20G epidural catheter
7. 5ml syringe with freely moving plunger
8. 5ml loss of resistance (LOR) syringe
9. Skin towel
10. Galley pot with swabs
11. Sponge holding forceps

DRUGS:

- Bupivacaine 0.5% hyperbaric solution – 4ml ampoule
- Lignocaine 2% with adrenaline (1:200000) solution

PERFORMING THE COMBINED SPINAL EPIDURAL BLOCKADE:

The patient was placed in lateral position on a horizontal operating table. The back of the patient was cleaned with povidone iodine and spirit. The excess of spirit wiped using a dry gauze.

The area of blockade was draped with sterile towel. L2-L3 space was selected for performing epidural catheterization and L3-L4 space was selected for subarachnoid blockade. L2-L3 space identified and epidural space identified using 18G epidural needle through loss of resistance technique. Epidural catheter threaded through that needle and tip placed 5cm cephalad. Epidural catheter secured using tapes.

L3-L4 space identified and dural tap was performed using 25G spinal needle. After free flow of CSF, 0.5% bupivacaine was injected (0.5, 1, 1.5, 2 ml each according to their respective group) at a rate of 0.2ml/second.

Immediately, the patients were turned on their back to supine position and a wedge placed under right gluteal region. Based on the level of sensory blockade achieved at 5^{th} minute, epidural topup given with 2% lignocaine with adrenaline(1:200000) 3cc every 3 minutes till sensory level T4(thoracic segment 4) was achieved. 6 liters of Oxygen given through face mask, till extraction of the baby. Observations were recorded.

OUTCOME MEASURES:

SENSORY BLOCK:

- Assessment of loss of temperature sensation done immediately after the intrathecal injection was made and continued every 15 seconds
- Onset of sensory block was kept as the time taken from intrathecal injection to loss of temperature sensation, as assessed by a cotton piece soaked in surgical spirit, at T4 level
- If sensory level of T4 was not achieved by 5^{th} minute, 2% lignocaine with adrenaline epidural topup given 3cc every 3 minutes till T4 sensory level was achieved.

VITAL SIGNS:

Pulse rate, systolic and diastolic blood pressure, SpO2, respiratory rate were recorded every 5 minutes throughout the intra-operative period.

- Hypotension, defined as fall of systolic BP 20% from the baseline or systolic BP of <90mm Hg whichever occurs first, was managed with rapid infusion of IV fluids and Inj. Ephedrine 6mg increments

- Bradycardia defined as Heart rate <60/min and was managed with Inj. Atropine 0.01mg/kg IV(if resistant to inj.ephedrine given for hypotension)

- Respiratory depression defined as RR<8/min or SpO2<92%, which was managed with bag and mask ventilation or intubation and IPPV if necessary.

QUALITY OF SURGICAL ANAESTHESIA:

- Excellent – no complaints of pain anytime during the surgery

- Good – minimal pain or discomfort – to be treated with Inj. Pentazocine 0.5mg/kg IV

- Poor – GA needs to be administered

NEONATAL APGAR SCORE:

PARAMETERS	0	1	2
HEART RATE	Absent	<100	>100
RESPIRATORY EFFORTS	Absent	Irregular, slow, gasping or shallow	Crying, robust
MUSCLE TONE	Absent	Some flexion of extremities	Active movement
CRY	No cry	grimace	Active crying
COLOUR	Cyanotic	Acrocyanosis Trunk pink	pink

OBSERVATION AND RESULTS

The study was conducted at Govt. Kasturba Gandhi Hospital for Women & Children, Madras Medical College, Triplicane, Chennai-5. 80 patients were included in the double blinded randomized controlled study. The patients were divided into four groups. Patient in group A received 0.5ml, group B receieved 1 ml, group C received 1.5ml and group D received 2ml of 0.5% bupivacaine intrathecally. Depending upon the level of sensory block achieved at 5^{th} minute of intrathecal injection, 2% lignocaine given epidurally, to achieve a sensory block level of T4.

STATISTICAL ANALYSIS:

The four groups were matched in respect of their age, height and weight by ANOVA (Analysis of Variance). The difference between them, were interpreted by the Post hoc test of Bonferroni. Similarly, 2% Lignocaine used, Ephedrine administration, Neonatal Apgar at 1^{st} and 5^{th} min and duration of surgery were compared between groups by ANOVA and interpreted the difference by Post hoc test of Bonferroni.

The sensory level of blockade achieved and the complications like dyspnea, shivering and vomiting were categorized and interpreted by 'Z' test of proportions. The above statistical procedures were performed by the statistical package IBM SPSS statistics 20. The P - values less than 0.05 ($P<0.05$) were treated as significant in two tail condition.

DEMOGRAPHIC DATA:

The four groups were comparable in respect to their age, weight and height. There was no statistical difference among the four groups.

Table-1. Matching of the four groups according to the age.

Group	**Mean**	**SD**	**ANOVA "F"**	**Df**	**Signific**
1	25.4	2.6	0.089	3, 76	**P>0.05**
2	25.1	3.0			
3	25.2	3.2			
4	25.3	3.1			

The mean ages of four groups were shown in the above table-1. The four groups were not significantly differed in respect of the age.

Table-2. Matching of the four groups according to the height.

Group	Mean	SD	ANOVA "F"	df	Signific
1	155.8	2.8	0.116	3, 76	**P>0.05**
2	156.6	2.7			
3	156.0	2.1			
4	155.8	3.1			

The mean height of the four groups were shown in the above table-2. The four groups were not significantly differed in respect of the Height (P>0.05)

Table-3. Matching of the four groups according to the weight.

Group	Mean	SD	ANOVA "F"	Df	Signific
1	55.8	2.7	2.469	3, 76	**P>0.05**
2	55.2	2.5			
3	55.2	2.3			
4	55.4	2.0			

The mean weight of the four groups were shown in the above table-3. The four groups were not significantly differed in respect of the weight (P>0.05).

DURATION OF SURGERY AND BASELINE BP:

There was no statistical significance among the groups in terms of duration of surgery and baseline systolic blood pressure. They are comparable.

Table-4. Matching of the four groups according to their base SBP.

Group	Mean	SD	ANOVA "F"	df	Signific
1	119.0	9.4	0.270	3, 76	**P>0.05**
2	121.0	8.3			
3	119.6	8.4			
4	118.7	9.0			

The baselines SBP of four groups were matched in the above table-4. The mean SBP of four groups were not significantly differed between them (P>0.05).

Table-5. Comparison of surgery duration between the four groups.

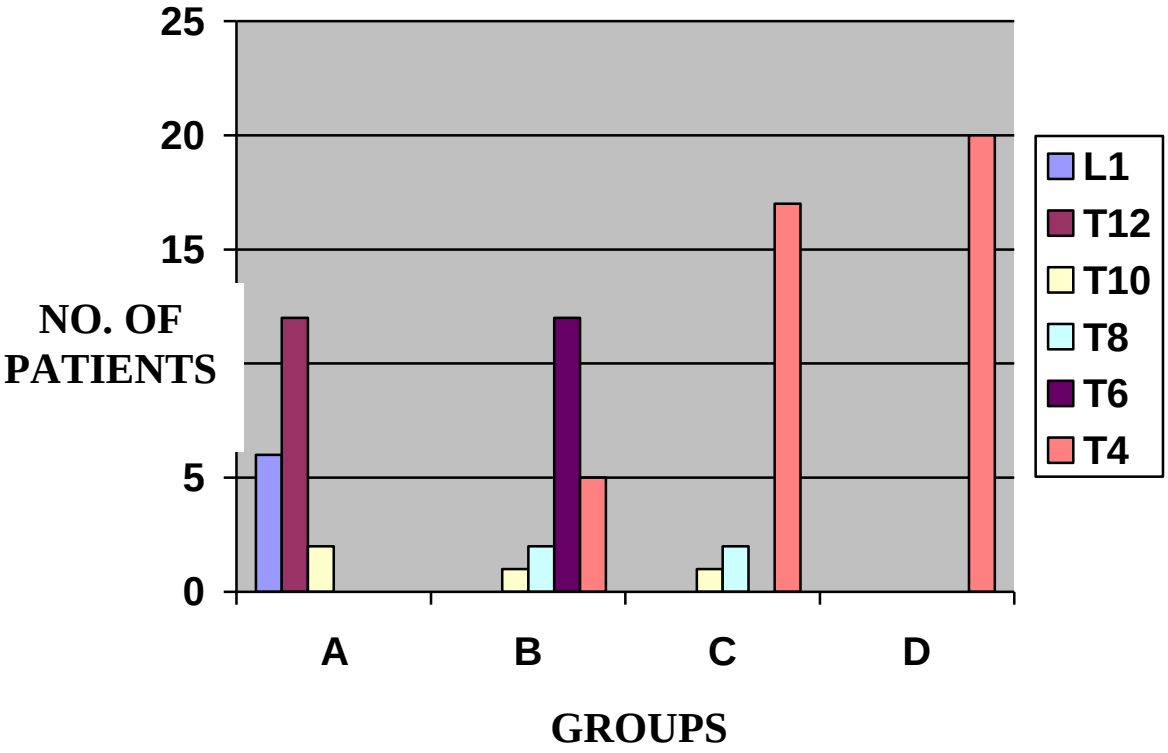
Group	Mean	SD	ANOVA "F"	df	Signific
1	65.2	4.9	2.469	3, 76	**P>0.05**
2	63.9	6.8			
3	60.8	8.5			
4	60.6	5.3			

The duration of surgery between four groups were compared in the above table-4. The mean duration of four groups were not significantly differed between them (P>0.05).

LEVEL OF SENSORY BLOCKADE:

Level of sensory blockade was assessed at 5^{th} minute after intrathecal injection of 0.5% bupivacaine.

The median level of sensory blockade achieved by Group A, B, C and D are T12, T6, T4 and T4 respectively and they were shown to be significant statistically with a P value <0.001.



GRAPH 1. SENSORY BLOCK HEIGHT AT 5TH MINUTE OF INTRATHECAL INJECTION

Table-6.Sensory level of blockade at 5th Min

Level	Group,A=2.5,B=5,C=7.5,D=10				Total	$\chi^{2/}$ / Signi
	1.00	2.00	3.00	4.00		
L1	6	0	0	0	6	122.000
T12	12	0	0	0	4	**P<0.001**
T10	2	1	1	0	12	
T8	0	2	2	0	42	
T6	0	12	0	0	12	
T4	0	5	17	20	4	
Total	20	20	20	20	80	
Median	**T12**	**T6**	**T4**	**T4**		

The above table -6 describes the level of Sensory blockade at 5th minute. Groups 1, 2, 3 and 4 were significantly associated with T12, T6, T4, T4 respectively (P<0.001).

EPIDURAL TOPUP REQUIREMENTS:

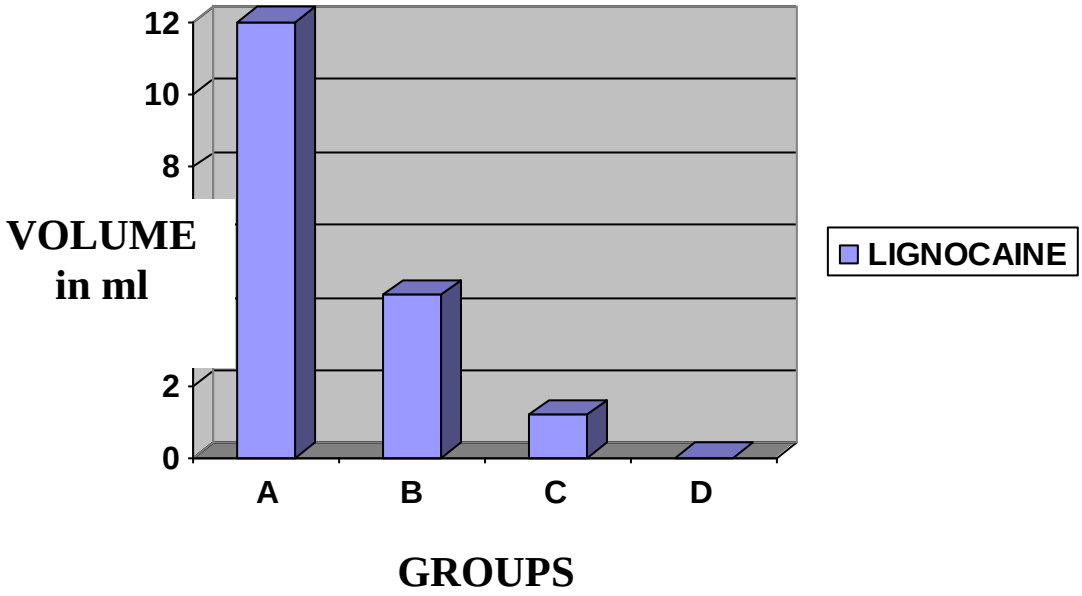
2% lignocaine administered epidurally, to attain a sensory block level of T4, was compared among the groups.

- 2% lignocaine was administered only in Groups A, B and C as group D achieved sensory level of T4 in all the patients.

- Group A with mean lignocaine use of 12ml was differed significantly from all other groups (**p<0.001**)

- Group B with mean lignocaine use of 4.5ml was differed significantly from all the other groups **(p<0.001**)

- Group C and D were not differed significantly (**p>0.05**). group C & D are comparable in respect to the lignocaine requirement.



GRAPH 2. AVERAGE AMOUNT OF LIGNOCAINE 2% USED EPIDURALLY

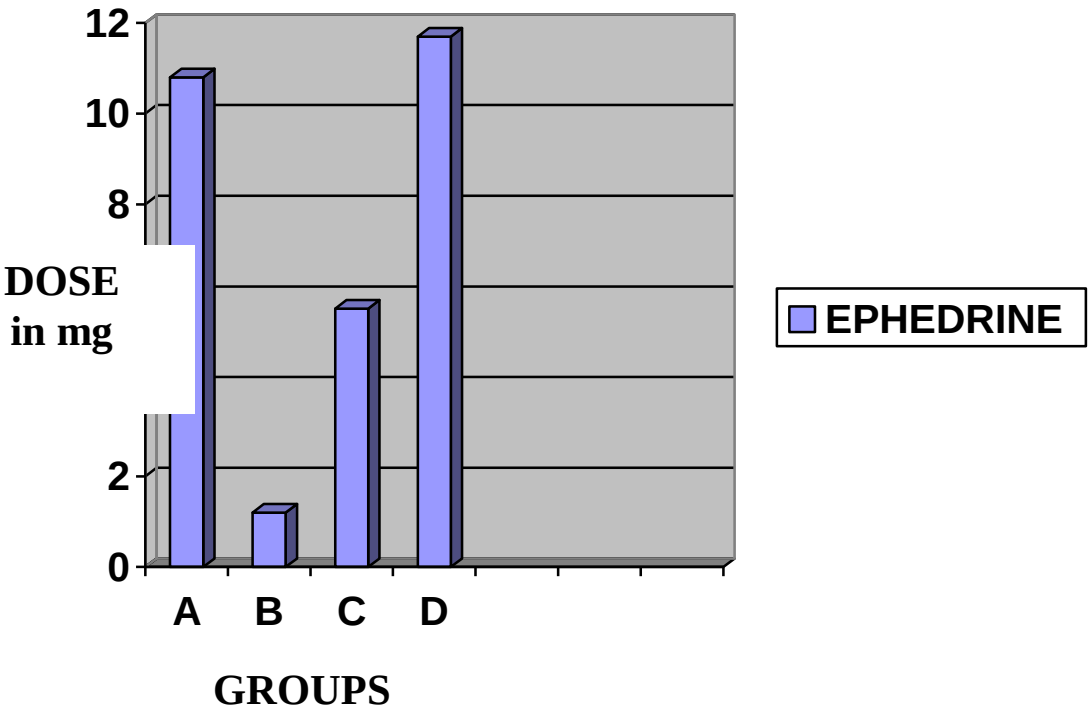
Table-7. 2% Lignocaine administration between the four groups

Group	Mean	Std. Deviation	ANOVA 'F'	df	Significance	Significantly differed groups
1	12.0	1.7				All differed except 3 and 4
2	4.5	3.2				
3	1.2	3.1	102.897	3, 76	**P<0.001**	
4	0.0	0.0				

EPHEDRINE ADMINISTRATION:

Ephedrine administration to treat hypotension was compared among the groups.

- Group A with a mean ephedrine usage of 10.8mg was differed significantly from groups B & C (**p<0.001**) but not group D.
- Group D with a mean ephedrine usage of 11.7mg was differed significantly from groups B & C (**p<0.001**) but not group A.
- Group B with a mean ephedrine usage of 1.2mg was differed significantly from groups A, C & D (**p<0.05**).
- Group A & D were comparable in respect to the ephedrine administration.



GRAPH 3. AVERAGE AMOUNT OF EPHEDRINE USED INTRAOPERATIVELY

Table-8. Ephedrine administration between the four groups

Group	Mean	SD	ANOVA 'F'	df	Significance	Significantly differed groups
1	10.8	3.7				All differed except 1 and 4
2	1.2	3.1				
3	5.7	4.6	31.098	3, 76	**P<0.001**	
4	11.7	4.1				

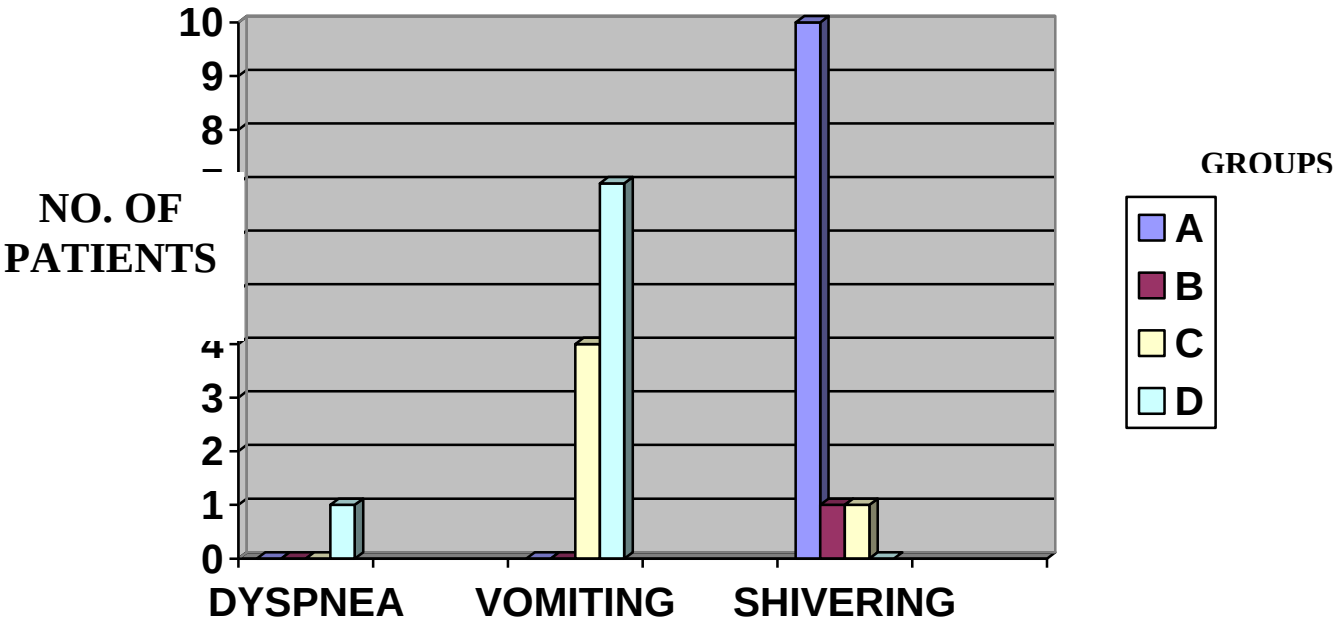
COMPLICATIONS:

Certain complications like vomiting, dyspnea, shivering were compared among the groups.

- Vomiting occurred in Group C & D with 20% and 35% of patients respectively, which was statistically insignificant(**p>0.05**). Group C and D were comparable with respect to the occurrence of vomiting.

- The incidence of shivering in Groups A, B & C are 50%, 5% & 5% respectively. Group A differed significantly from Group B & C in respect to the incidence of shivering (**p<0.001**). Shivering was significantly associated with Group A.

- Dyspnea occurred only in one patient in Group D.



GRAPH 4. INTRAOPERATIVE COMPLICATIONS

Table-9. Complications.

Complications	Group 1		Group 2		Group 3		Group 4	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
Dyspnea	0	0.0	0	0.0	0	0.0	1	5.0
vomiting	0	0.0	0	0.0	4	20.0	7	**35.0**
Shivering	10	**50.0**	1	5.0	1	5.0	0	0.0

OTHER PARAMETERS:

The quality of surgical anaesthesia rated as good, moderate or poor and the neonatal apgar at 1st and 5th minute after birth were compared and there was no statistical significance among the groups.

Table-10. NA administration at different time interval between the four groups

Variable	Group	Mean	S D	ANOVA 'F'	df	Significance	Significantly differed groups
NA1 Min	1	5.4	0.5	.704	3, 76	P>0.05	Nil
	2	5.6	0.5				
	3	5.4	0.5				
	4	5.45	0.5				
NA5 Min	1	8.45	0.5	.585	3, 76	P>0.05	Nil
	2	8.6	0.5				
	3	8.45	0.5				
	4	8.6	0.5				

DISCUSSION

Till today, spinal anaesthesia is the most versatile block available and is being used for various surgeries on the lower half of our body. Spinal anaesthesia is widely used for cesarean deliveries.

Conventionally, 10mg of 0.5% bupivacaine is used intrathecally for cesarean delivery. This results in greater hemodynamic instability and respiratory depression.

Combined spinal epidural was introduced by **Brownridge** in the year 1981 for cesarean section. CSE technique allows the use of low dose intrathecal bupivacaine, which resulted in less hemodynamic instability. It had an added advantage of prolonging the anaesthesia through the epidural catheter. Moreover parturients can be rendered postop pain relief, which made the technique more popular.

Low dose intrathecal bupivacaine in CSE technique offers better analgesia and hemodynamic stability, which allows its use in parturients with cardiac disease.

This study compared four different doses of intrathecal bupivacaine in combined spinal epidural technique to evaluate the optimum dose of intrathecal bupivacaine with epidural lignocaine in CSE technique for cesarean section

LEVEL OF SENSORY BLOCKADE:

Sensory blockade level (sensation to cold) necessary for a caesarean section is T4. Both groups C & D i.e, with 7.5mg & 10 mg of 0.5% bupivacaine attained T4 level at 5th minute after intrathecal injection. With 2.5mg of 0.5% bupivacaine, the mean level achieved was T12 and with 5mg of 0.5% bupivacaine the mean level achieved was T6.

This correlated with the study done by **Shou-Zen Fan et al**[12], where they compared in the similar way and the sensory block heights produced by 2.5, 5, 7.5 & 10mg were T11, T9, T5 & T4 respectively.

The result also correlates with the study done by **Roofthoft E et al**[13], where 5-7mg of 0.5% bupivacaine intrathecally was sufficient to provide effective anaesthesia, which is similar to our study, where 5mg of bupivacaine achieved a mean sensory block level of T6.

Adequate level of sensory blockade(T4) achieved by 7.5mg bupivacaine intrathecally in 85% of the patients was supported by the study done by **Leo S et al**[14], in which the time taken to achieve T4 level in 7mg, 8mg and 9 mg groups of 0.5% bupivacaine were similar in all the groups, indicating that 7mg was enough to achieve adequate level of anaesthesia in caesarean section.

Even 6.6mg of hyperbaric bupivacaine with sufentanyl as an adjuvant produced sensory block level of T4 without epidural supplementation in more than 80% of the patients involved in the study conducted by **Marcel P Vercauteran et al**[26], which strongly correlates with the results of our study.

EPIDURAL TOPUP REQUIREMENTS:

2% lignocaine epidural topup requirement was more in Group A (2.5mg) requiring 12ml and minimal with group B(5mg) requiring 4.5ml. Group C & D i.e, 7.5mg & 10 mg groups rarely required epidural topups.

This correlated with **shou-Zen Fan et al**[12] study, where 2.5, 5, 7.5 & 10 mg of 0.5% bupivacaine intrathecally required an epidural topup doses of 2% lignocaine of about 22ml, 10.1ml, 1.2ml & 0ml respectively.

Though the amount of 2% lignocaine required in their study was larger than our study, the ratio of 2% lignocaine used among the groups correlated well with our study(2:1). The difference in amount of 2% lignocaine required might be due to the demographic pattern being different in each areas, where the studies were conducted.

6.6mg of hyperbaric bupivacaine with 25 mcg fentanyl intrathecally was studied in caesarean section by **Marcel P Vercauteran et al**[26]. Even at such low doses, sensory block level of T4 was achieved without the need for epidural topup in more than 80% of the study group, which strongly correlates with this study where little/no supplementation of epidural lignocaine was required in 5mg(4.5ml of lignocaine) and 7.5mg(1.2 ml of lignocaine) groups.

COMPLICATIONS:

HYPOTENSION:

The occurrence of hypotension was assessed among the groups

- All the patients (100%), who received 2.5mg of 0.5% bupivacaine had hypotension because of high dose requirement of 2% lignocaine epidurally.

- All the patients (100%), who received 10mg of 0.5% bupivacaine also had hypotension

- In patients, who received 7.5mg of o.5% bupivacaine, the incidence of hypotension was 70%.

- In patients, who received 5 mg of o.5% bupivacaine, the incidence of hypotension was less 15%.

This correlated with the study by **Shou-Zen Fan et al**[12], where the incidence of hypotension was 5%, 5%, 35% and 50% in 2.5mg, 5mg, 7.5mg & 10mg of 0.5% bupivacaine groups respectively.

5mg bupivacaine group had good hemodynamic stability with minimal side effects in this study correlates well with the study done by **Roofthooft et al**[13], where intrathecal bupivacaine between 5mg and 7mg was found to produce effective anaesthesia for caesarean section in CSE technique with improved hemodynamic stability.

7mg bupivacaine provided adequate anaesthesia for cesarean delivery with reduced incidence of hypotension when compared to 8mg and 9mg groups in the study done by **Leo S et al**[14], which is similar to our study results.

5 mg bupivacaine with fentanyl was shown to produce effective anaesthesia with less hypotension, vasopressor requirements and nausea than spinal anaesthesia with 10 mg bupivacaine, in the study conducted by **David B et al**[18]. This correlated well with our study results.

The study done by **Langesaeter E et al**[19] also supports our study results, where better hemodynamic stability was achieved with less incidence of hypotension in parturients, who received 7mg spinal bupivacaine , when used along with low dose infusion of phenylephrine and minimal co-hydration.

EPHEDRINE USE:

This correlated well with the incidence of hypotension.

- Group A(2.5mg) & group D(10mg) were similar in their ephedrine requirements with 10.8mg and 11.7mg mean respectively.
- Group C(7.5mg) required an average of 5.7mg of ephedrine
- Group B(5mg) required least amount of ephedrine which is about 1.2mg.

VOMITING:

Vomiting occurred mainly in Group D(10mg) & Group C(7.5mg) and the incidence is 20% & 35% respectively. No vomiting was reported in 2.5mg and 5 mg group patients.

This correlated with the study by **Shou-Zen Fan et al**[12], where the incidence of vomiting is 10% & 20% in 7.5mg & 10mg groups of 0.5% bupivacaine respectively.

SHIVERING:

Shivering occurred predominantly in group A(2.5mg) with an incidence of about 50%. In other groups it was found to be insignificant.

This correlated with **Shou-Zen Fan et al**[12] where the incidence of shivering was highest with 2.5mg group of 0.5% bupivacaine with 25% occurrence.

Thermoregulatory control was impaired during regional anaesthetic technique, where the thermoregulatory processing is similar between epidural and spinal anaesthesia (**Osaki M et al**[27]).

The high incidence of shivering in 2.5 mg bupivacaine group when compared to all other groups might be due to

- Large amount of epidural supplementation
- The time taken to achieve adequate level of anaesthesia was high in 2.5mg bupivacaine group when compared to other groups.
- High spinal level achieved immediately in 10mg and 7.5mg bupivacaine group, might have masked the shivering response in these parturients.

DYSPNEA:

Dyspnea occurred in only one patient in group D(10mg). No occurrence in other groups. This might probably be due to

- High dose of the intrathecal bupivacaine used(10mg)
- Height of that parturient was in the lower range of the groups(150 cm)
- Twin pregnancy, which increases the cephalad spread of the intrathecal drug faster due to epidural venous engorgement.

The spread of spinal anaesthesia in singleton and twin pregnancies were compared in the study conducted by **Jawan B et al**[28], where it was observed that fast onset and maximum cephalad spread was present among the twin pregnancies. The twin pregnancy group had heavier, large uterus and very high production of progesterone when compared to singleton pregnancies, which resulted in higher level of blockade and respiratory problems in this group.

SUMMARY

This double blinded prospective randomized controlled study was designed to evaluate the optimum dose of hyperbaric bupivacaine with epidural lignocaine necessary to produce adequate anaesthesia without hemodynamic instability in combined spinal epidural technique for caesarean section. Four different doses of intrathecal hyperbaric 0.5% bupivacaine (2.5mg,5mg, 7.5mg & 10mg) were compared.

The following observations were made:

- Both 7.5mg and 10mg of 0.5% bupivacaine intrathecally produced adequate level of anaesthesia (T4) in most of the cases. But the occurrence of hypotension and vomiting were very high in these groups.
- 2.5mg of 0.5% bupivacaine intrathecally produced a median sensory block level of T12, which required high doses of epidural supplementation of 2% lignocaine. This resulted in high occurrence of hypotension and shivering.

- 5mg of 0.5% bupivacaine intrathecallyproduced adequate level of anaesthesia with minimal supplementation of epidural topup with 2% lignocaine. The occurrence of hypotension, vomiting and shivering were very less compared to other groups.
- There was no significant difference among the groups in terms of heart rate changes, quality of surgical anaesthesia and neonatal apgar

CONCLUSION

We conclude that 5mg of 0.5% bupivacaine intrathecally with minimal epidural lignocaine can produce adequate and rapid anaesthesia for caesarean section with minimal adverse effects.

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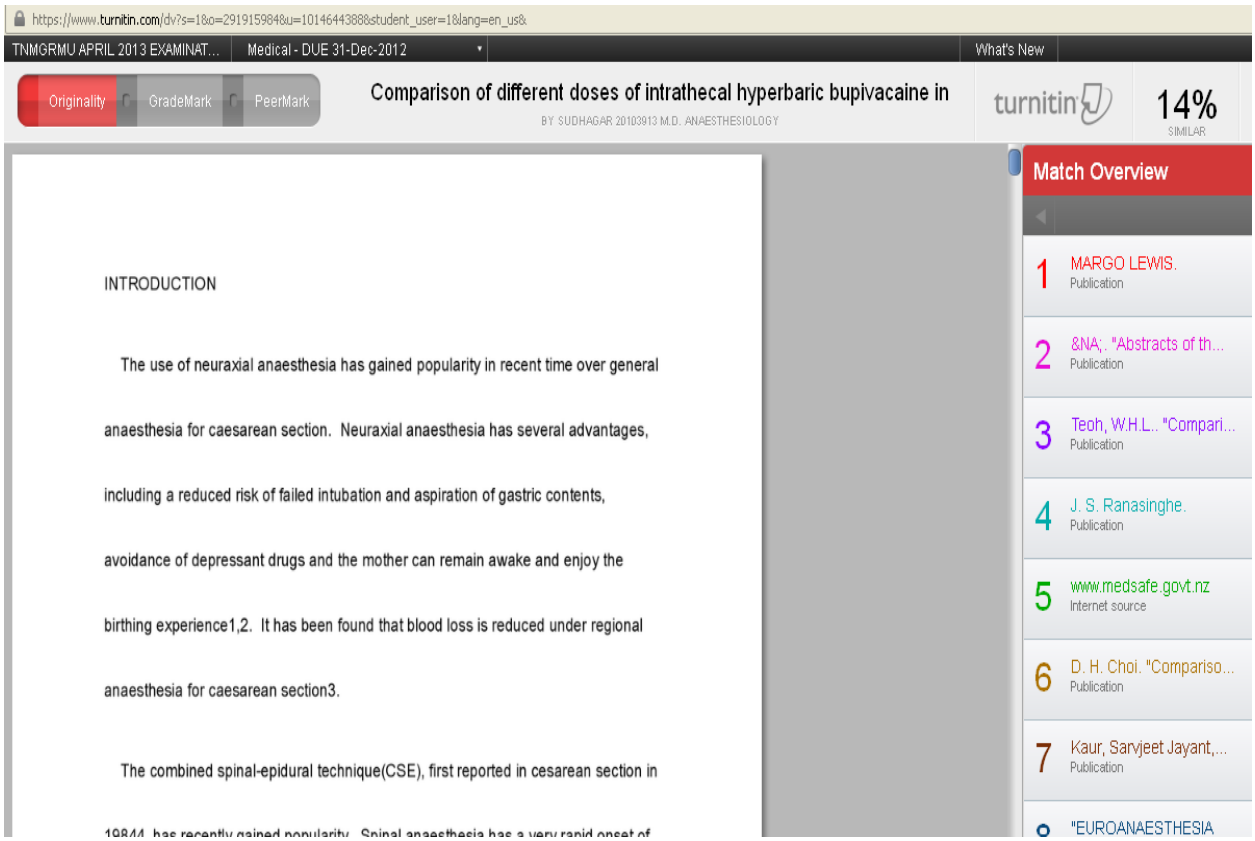
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Comparison of different doses of intrathecal hyperbaric bupivacaine in
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INTRODUCTION
The use of neuraxial anaesthesia has gained popularity in recent time over general anaesthesia for caesarean section. Neuraxial anaesthesia has several advantages, including a reduced risk of failed intubation and aspiration of gastric contents, avoidance of depressant drugs and the mother can remain awake and enjoy the birthing experience1,2. It has been found that blood loss is reduced under regional anaesthesia for caesarean section3.
The combined spinal-epidural technique(CSE), first reported in cesarean section in
Match Overview
1 MARGO LEWIS. Publication
2 &NA;. "Abstracts of th... Publication
3 Teoh, W.H.L.. "Compari... Publication
4 J. S. Ranasinghe. Publication
5 www.medsafe.govt.nz Internet source
6 D. H. Choi. "Compariso... Publication
7 Kaur, Sarvjeet Jayant,... Publication
"EUROANAESTHESIA

PROFORMA

GROUP A

NAME: **PRIMI / G P L A**
AGE: **INDICATION FOR CAESAREAN:**
IP NO:
GESTATIONAL AGE: **SX : STARTING TIME:**
HT: cm. **FINISHING TIME:**
WT: kg. **GROUP: A / B / C / D**

EVENTS	DRUGS	TIME	BP	PR	SpO2	IVF

- **SENSORY LEVEL AFTER 5 MINS:**
- **2% LIGNOCAINE USED(total ml):**
- **EPHEDRINE USED (total mg):**

- **DYSPNEA**
- **NAUSEA/ VOMITING**
- **SHIVERING**
- **OTHER COMP:**

- **QUALITY OF SURGICAL ANAESTHESIA**

GOOD / MOD/ POOR

- **NEONATAL APGAR**
  1ST MIN - /10
  2ND MIN - /10

NO.	NAME	AGE	GA wks	OC	IND	HT cms	WT Kg	SL 10th min	2% LIG ml
1	DEEPA	26	38	G2P1L1	PREV CS	154	54	T12	12
2	VANITHA	26	39	G3P1L1	PREV CS	154	59	T12	12
3	VIJI	22	38	PRIMI	BREECH	158	54	T12	12
4	ADHILAKSHMI	25	39	PRIMI	CPD	158	58	T12	12
5	SELVI	24	38	G3P1L1	PREV CS	161	56	L1	12
6	JANAKI	20	38	PRIMI	CPD	158	58	L1	12
7	SARANYA	22	38	PRIMI	CPD	150	52	T10	12
8	GOWRI	30	38	G2P1L1	PREV CS	158	58	L1	15
9	VANITHA RANI	25	38	PRIMI	CPD	152	54	T10	12
10	SHAKTHI	27	38	G2P1L1	PREV CS	158	53	L1	15
11	RAJALAKSHMI	23	38	G3A2	PB	160	58	L1	12
12	JOHARA	23	38	G2P1L1	BREECH	154	58	T12	9
13	BHUVANESHWARI	25	38	G3P1L1	PREV CS	156	60	T12	12
14	JAYAPRIYA	25	38	PRIMI	TWIN	153	58	T12	12
15	KAVITHA	27	38	G3P2L1	PREV CS	158	52	L1	15
16	SUJATHA	27	38	G2P1L1	PREV CS	154	52	T12	9
17	NAZEERA BEGAM	27	38	G3P1L1A1	PREV CS	156	54	T12	12
18	SUNDARI	30	38	G4P3L1	PREV CS	155	58	T12	12
19	ESTHER	29	38	G2P1L1	TWIN	154	52	T12	9
20	PUSHPA	26	38	PRIMI	CPD	156	57	T12	12

NO.	NAME	EPH mg	COMP (D/NV/S)	OTHER COMP	DUR min	MR (G/M/P)	NA 1st min	NA 5th min	PS (G/M/P)
1	DEEPA	6	S		64	G	6	9	G
2	VANITHA	6			70	G	6	9	G
3	VIJI	18	S		64	G	5	8	G
4	ADHILAKSHMI	12			62	G	5	8	G
5	SELVI	12	S		68	G	5	9	G
6	JANAKI	12			64	G	5	8	G
7	SARANYA	12	S		64	G	6	9	G
8	GOWRI	12	S		68	G	5	8	G
9	VANITHA RANI	12	S		68	G	6	9	G
10	SHAKTHI	12	S		70	G	5	8	G
11	RAJALAKSHMI	12			66	G	5	8	G
12	JOHARA	6			72	G	6	9	G
13	BHUVANESHWARI	6	S		54	G	5	8	G
14	JAYAPRIYA	12			62	G	6	9	G
15	KAVITHA	18	S		64	G	5	8	G
16	SUJATHA	6			74	G	6	9	G
17	NAZEERA BEGAM	6			56	G	5	8	G
18	SUNDARI	12			62	G	5	8	G
19	ESTHER	12			68	G	6	9	G
20	PUSHPA	12	S		64	G	5	8	G

MASTER CHART

GROUP A BLOOD PRESSURE CHANGES

	base line sys	dias	1st sys	min dias	2nd sys	min dias	5th sys	min dias	10th sys	min dias	15th sys	min dias	20th sys	min dias
1	130	80	130	80	124	80	122	78	110	74	94	70	112	72
2	122	70	120	70	105	64	105	64	92	62	112	70	114	74
3	108	70	108	70	108	68	104	68	82	58	84	58	92	58
4	110	72	110	72	112	72	112	72	80	60	76	58	94	60
5	112	72	112	72	112	72	112	72	82	60	78	58	94	60
6	132	76	132	76	130	70	128	70	112	70	100	64	82	62
7	100	64	100	64	98	64	100	64	92	60	80	54	82	54
8	116	70	116	70	114	70	124	70	118	64	82	52	78	52
9	108	70	108	70	104	70	98	70	98	70	94	70	94	64
10	122	68	122	68	124	68	120	68	116	64	114	64	88	56
11	128	76	128	76	124	76	124	70	116	68	108	64	86	56
12	120	80	120	80	118	80	104	76	100	76	88	70	96	72
13	124	74	124	74	122	74	118	70	118	70	98	68	86	64
14	122	72	122	72	112	70	110	70	108	70	90	62	108	70
15	112	68	112	68	110	68	110	62	110	62	82	56	84	56
16	134	70	130	70	122	62	112	60	110	60	92	70	110	70
17	132	64	132	60	134	64	124	70	118	70	94	70	112	74
18	110	68	110	68	108	68	120	68	118	68	82	56	82	58
19	118	74	118	74	112	74	126	80	122	80	80	60	82	60
20	120	70	120	70	130	72	132	72	128	70	108	70	84	60

	25th sys	min dias	30th sys	min dias	40th sys	min dias	50th sys	min dias	60th sys	min dias
1	112	74	114	74	118	74	120	74	120	74
2	114	78	120	78	120	78	122	78	130	80
3	98	58	98	60	98	60	100	60	102	60
4	94	64	98	64	98	64	98	70	98	70
5	94	60	98	64	98	62	100	70	100	70
6	80	62	98	64	108	68	108	68	110	68
7	96	60	96	60	104	60	108	62	108	62
8	98	52	98	54	100	54	100	56	108	56
9	84	62	84	62	98	70	98	70	112	70
10	84	56	112	60	112	60	124	64	124	64
11	86	56	98	60	112	64	114	64	128	64
12	96	74	112	76	112	76	118	76	126	78
13	114	68	114	70	114	70	118	70	120	70
14	110	72	110	72	114	74	122	74	124	78
15	86	58	112	68	112	70	112	70	112	74
16	112	74	124	74	124	74	124	74	124	74
17	120	76	120	76	124	76	124	78	124	78
18	94	70	94	72	100	70	100	70	112	74
19	100	64	100	64	108	64	108	64	110	64
20	82	58	98	72	98	72	104	72	104	74

GROUP A HEART RATE CHANGES

	base line	1st min	2nd min	5th min	10th min	15th min	20th min	25th min	30th min	40th min	50th min	60th min
1	64	62	54	54	50	52	52	54	54	52	52	52
2	60	60	54	54	52	54	56	60	56	56	58	62
3	70	72	70	68	64	67	68	68	64	66	68	70
4	98	94	70	72	72	74	74	66	72	72	78	74
5	62	64	64	62	58	54	54	56	58	56	54	56
6	78	74	72	64	64	62	64	64	62	60	64	64
7	90	84	72	70	64	68	64	68	68	72	72	78
8	82	80	74	72	74	70	74	78	77	72	73	74
9	72	70	78	56	52	56	54	54	58	60	65	64
10	56	54	52	54	50	52	52	60	54	56	58	58
11	62	62	62	62	60	56	58	58	54	54	54	56
12	94	92	84	76	64	65	64	62	58	64	64	62
13	64	62	60	58	54	54	54	52	50	54	58	56
14	77	74	62	62	64	64	56	58	57	54	64	64
15	82	78	78	74	74	72	62	52	52	52	58	60
16	62	62	54	52	50	52	52	54	54	51	52	54
17	58	60	52	54	52	54	56	60	56	56	58	64
18	72	70	70	68	63	67	68	68	66	66	68	70
19	94	94	70	70	72	74	74	66	72	70	78	74
20	67	64	64	62	58	54	54	56	58	54	54	56

GROUP B

NO.	NAME	AGE	GA wks	OC	IND	HT cms	WT Kg	SL 10th min	2% LIG ml
1	UNNAMALAI	21	38	G2P1L1	PREV CS	153	52	T6	3
2	VIDHYA	28	38	G2P1L1	PREV CS	160	56	T6	6
3	VALLI	26	37	PRIMI	CPD	154	52	T6	6
4	PAVEENA	22	38	PRIMI	CPD	152	54	T4	0
5	SARASWATHI SHAMED	23	38	G2P1L1	PREV CS	152	54	T4	0
6	FAKHIYA	25	38	G2P1L1	PREV CS	156	54	T6	6
7	PARVATHY	25	38	G2P1L1	PREV CS	154	52	T6	6
8	REVATHI	25	38	G3P1L1A1	CPD	156	58	T6	6
9	RENUKA DEVI	23	38	PRIMI	CPD	154	54	T6	6
10	FAREEDA	23	38	G2P1L1	PREV CS	154	52	T4	0
11	AMUTHA SELVI	27	38	G3P1L1A1	PREV CS	158	54	T10	12
12	RATHI	23	38	G2P1L0	PREV CS	152	56	T4	0
13	THULASI	23	38	G2P1L1	PREV CS	158	56	T8	6
14	FATHIMA	30	38	G2P1L1	PREV CS	154	56	T6	6
15	SUGANTHI	22	38	G2P1L1	PREV CS	158	57	T6	6
16	SUDHA	30	38	G3P1L1A1	PREV CS	158	57	T6	6
17	NITHYA	23	38	G2P1L1	PREV CS	159	59	T4	0
18	JAYA	24	38	PRIMI	CPD	152	52	T6	3
19	PARIMALA	30	38	G2P1L1	PREV CS	159	58	T6	6
20	KAUSAR	30	38	G3P1L1	PREV CS	158	60	T8	6

NO.	NAME	EPH mg	COMP (D/NV/S)	OTHERS COMP	DUR min	MR (G/M/P)	NA 1st min	NA 5th min	PS (G/M/P)
1	UNNAMALAI	0			74	G	5	9	G
2	VIDHYA	0			64	G	5	8	G
3	VALLI	0			64	G	5	9	G
4	PAVEENA	6			64	G	5	9	G
5	SARASWATHI SHAMED	6			64	G	5	9	G
6	FAKHIYA	0			54	G	6	8	G
7	PARVATHY	0			62	G	6	9	G
8	REVATHI	0			60	G	6	9	G
9	RENUKA DEVI	0			54	G	6	9	G
10	FAREEDA	0			58	G	6	8	G
11	AMUTHA SELVI	12	S		78	G	6	9	G
12	RATHI	0			72	G	5	9	G
13	THULASI	0			64	G	6	9	G
14	FATHIMA	0			52	G	6	8	G
15	SUGANTHI	0			68	G	6	9	G
16	SUDHA	0			70	G	6	8	G
17	NITHYA	0			62	G	6	8	G
18	JAYA	0			70	G	5	9	G
19	PARIMALA	0			60	G	5	8	G
20	KAUSAR	0			64	G	6	8	G

GROUP B BLOOD PRESSURE CHANGES

	base sys	line dias	1st sys	min dias	2nd sys	min dias	5th sys	min dias	10th sys	min dias	15th sys	min dias	20th sys	min dias
1	124	70	124	70	122	70	100	68	96	68	98	66	98	64
2	118	68	118	68	124	72	108	68	104	64	98	70	98	70
3	128	68	130	68	134	68	112	68	108	68	104	64	102	64
4	132	70	144	74	144	78	92	70	112	68	108	68	110	68
5	112	70	112	70	120	74	80	64	94	70	94	70	110	72
6	124	72	124	74	132	70	120	70	110	70	112	74	108	74
7	120	74	120	74	124	74	108	70	108	70	104	70	104	70
8	130	80	130	80	124	74	112	74	108	70	108	70	108	74
9	112	70	112	70	110	70	98	70	98	70	100	72	102	72
10	132	70	130	70	134	72	110	64	108	62	104	60	104	60
11	122	90	122	90	134	92	128	90	122	90	118	94	104	78
12	124	70	124	70	128	70	100	70	100	68	100	68	104	70
13	120	70	120	70	118	70	94	70	94	70	98	70	98	72
14	132	82	132	82	130	82	112	74	112	74	108	70	108	70
15	110	70	110	70	118	70	92	64	94	64	108	68	108	68
16	108	74	108	74	110	74	90	70	92	72	100	70	98	70
17	114	78	114	78	124	78	94	70	96	70	100	72	100	74
18	124	70	124	70	124	70	108	64	108	68	104	64	104	64
19	128	90	120	90	130	90	104	90	104	90	108	92	104	84
20	106	74	104	64	106	64	92	56	92	56	94	56	94	56

	25th sys	min dias	30th sys	min dias	40th sys	min dias	50th sys	min dias	60th sys	min dias
1	98	64	100	68	100	68	104	64	104	68
2	100	70	100	74	100	74	104	74	98	70
3	112	64	112	64	118	64	120	70	120	70
4	108	70	118	68	118	68	120	70	120	70
5	108	70	108	72	112	74	120	74	112	74
6	108	74	112	70	112	70	120	74	122	74
7	112	72	112	72	112	74	112	78	124	78
8	110	72	110	72	112	74	114	74	128	74
9	102	70	108	74	108	74	110	74	112	78
10	104	64	118	70	118	70	120	70	120	74
11	86	64	84	64	110	70	110	70	124	70
12	104	70	104	74	104	72	108	70	108	72
13	100	74	104	74	104	74	110	78	108	78
14	110	74	110	74	118	80	118	74	120	80
15	108	70	108	70	110	70	110	70	112	74
16	98	72	98	74	94	70	92	70	98	74
17	104	78	104	78	108	78	112	78	112	78
18	102	64	108	68	108	68	110	68	110	68
19	104	84	110	84	110	84	110	84	112	84
20	94	56	98	56	98	58	100	62	100	62

GROUP B HEART RATE CHANGES

	base line	1st min	2nd min	5th min	10th min	15th min	20th min	25th min	30th min	40th min	50th min	60th min
1	76	74	62	60	64	64	56	58	54	54	64	64
2	80	78	76	74	74	70	62	52	52	52	58	62
3	72	70	70	68	63	67	68	68	62	66	68	70
4	64	62	62	60	58	58	62	60	58	54	52	56
5	60	62	54	52	50	52	52	54	54	51	52	56
6	60	60	52	54	50	54	56	60	56	54	58	62
7	74	70	70	68	63	67	68	68	64	66	68	70
8	94	94	70	70	72	74	72	66	70	70	78	72
9	68	64	64	62	58	54	54	56	58	54	54	54
10	70	70	70	62	63	64	68	62	64	66	68	70
11	74	72	68	68	64	58	54	54	52	58	60	68
12	92	84	72	70	64	68	64	68	68	72	72	78
13	82	80	74	72	74	70	74	78	77	72	73	74
14	70	70	78	56	52	56	54	54	58	63	65	64
15	60	62	62	62	60	56	58	58	54	54	54	56
16	92	92	84	76	64	65	64	62	56	64	64	62
17	62	62	60	58	54	52	54	52	50	54	58	56
18	90	84	72	70	68	68	64	68	64	72	72	78
19	80	82	74	72	74	72	74	77	77	72	73	74
20	82	80	74	66	64	62	56	58	62	62	61	60

GROUP C

NO.	NAME	AGE	GA wks	OC	IND	HT cms	WT Kg	SL 10th min	2% LIG ml
1	SUMATHY	21	37	PRIMI	CPD	156	52	T4	0
2	SURYA	21	38	PRIMI	BREECH	156	52	T8	6
3	RAJESHWARI	20	38	PRIMI	BREECH	156	60	T4	0
4	ANJALAI	20	38	PRIMI	CPD	153	54	T4	0
5	NAGAJOTHI	26	38	PRIMI	CPD	156	54	T4	0
6	UDAYALAKSHMI	26	38	G3P2L2	PREV CS	152	54	T4	0
7	POONGODHAI	26	38	PRIMI	CPD	154	54	T4	0
8	ALAMELU	25	38	G2P1L1	PREV CS	159	56	T4	0
9	INDHUMATHY	29	38	G3P1L1A1	PREV CS	154	60	T4	0
10	CHELLAPRIYA	27	38	PRIMI	CPD	154	53	T4	0
11	GOPIRANI	25	38	G2P1L1	PREV CS	159	54	T4	0
12	SANKARI	23	38	G2P1L1	PREV CS	158	58	T4	0
13	DHANALAKSHMI	29	38	G2P1L1	PREV CS	157	54	T4	0
14	SELVI	24	38	G3P1L1A1	PREV CS	158	56	T4	0
15	AMULU	25	38	G3P2L2	PREV CS	156	54	T4	0
16	USHA	25	38	G2P1L1	PREV CS	154	56	T4	0
17	SHAMEEM	29	38	G2P1L1	PREV CS	158	56	T4	0
18	SHENBAGAVALLI	30	38	PRIMI	CPD	156	54	T8	6
19	RANI	30	38	G3P2L2	PREV CS	156	55	T4	0
20	SHYAMALA DEVI	24	38	G2P1L1	PREV CS	159	58	T10	12

NO.	NAME	EPH mg	COMP (D/NV/S)	OTHERS COMP	DUR min	MR (G/M/P)	NA 1st min	NA 5th min	PS (G/M/P)
1	SUMATHY	0			54	G	5	9	G
2	SURYA	6			54	G	5	9	G
3	RAJESHWARI	12	NV		52	G	6	9	G
4	ANJALAI	12	NV		54	G	5	8	G
5	NAGAJOTHI	0			58	G	6	9	G
6	UDAYALAKSHMI	12	NV		68	G	5	8	G
7	POONGODHAI	6			52	G	5	8	G
8	ALAMELU	6			72	G	5	8	G
9	INDHUMATHY	6			60	G	5	8	G
10	CHELLAPRIYA	6			64	G	5	8	G
11	GOPIRANI	0			74	G	5	8	G
12	SANKARI	6			62	G	6	9	G
13	DHANALAKSHMI	6			50	G	6	9	G
14	SELVI	6			64	G	6	8	G
15	AMULU	12			56	G	6	9	G
16	USHA	0			64	G	5	8	G
17	SHAMEEM	0			70	G	5	8	G
18	SHENBAGAVALLI	6			54	G	6	9	G
19	RANI	0			54	G	6	9	G
20	SHYAMALA DEVI	12	S/NV		80	G	5	8	G

GROUP C BLOOD PRESSURE CHANGES

	base line sys	dias	1st min sys	dias	2nd min sys	dias	5th min sys	dias	10th min sys	dias	15th min sys	dias	20th min sys	dias
1	124	70	124	70	128	70	100	70	100	68	100	68	104	70
2	128	70	120	72	124	72	118	70	108	68	104	64	86	56
3	122	70	122	70	128	74	82	64	94	70	82	62	98	68
4	130	92	130	92	130	94	108	82	94	70	82	68	102	70
5	120	74	120	74	124	74	108	70	108	70	104	70	104	70
6	108	80	108	80	110	80	84	64	82	62	108	74	112	74
7	116	74	116	74	114	74	84	56	94	70	94	70	96	70
8	132	94	132	92	124	90	100	80	84	64	100	70	100	70
9	126	84	126	84	128	84	108	70	88	62	94	64	94	64
10	124	74	124	74	124	74	82	60	98	62	98	64	98	66
11	130	82	132	82	130	82	112	74	112	74	108	70	108	70
12	106	70	106	70	104	70	80	60	94	60	94	60	98	64
13	112	78	112	78	120	78	78	56	92	60	94	60	100	64
14	124	72	124	72	128	72	88	64	98	64	98	64	100	64
15	110	70	110	70	112	70	76	54	82	58	94	70	94	70
16	118	68	118	68	124	72	108	68	104	64	98	70	98	70
17	128	68	130	68	134	68	112	68	108	68	104	64	102	64
18	114	68	114	70	114	70	84	58	94	60	94	60	98	62
19	112	70	112	70	110	70	98	70	98	70	100	72	102	72
20	108	74	108	74	104	74	82	56	84	56	92	60	94	60

	25th min sys	dias	30th min sys	dias	40th min sys	dias	50th min sys	dias	60th min sys	dias
1	104	70	104	74	104	72	108	70	108	72
2	100	60	102	62	104	62	104	64	108	68
3	100	70	100	74	108	74	108	78	110	78
4	102	74	108	74	108	78	112	78	120	78
5	112	72	112	72	112	74	112	78	124	78
6	112	78	118	80	118	80	124	82	124	80
7	98	72	98	74	100	74	100	74	108	74
8	102	70	102	72	102	74	102	74	108	74
9	98	64	98	64	100	68	100	68	112	68
10	100	66	108	70	112	74	124	76	124	78
11	110	74	110	74	118	80	118	74	120	80
12	98	64	108	64	108	68	110	68	110	70
13	104	64	104	64	108	64	108	64	110	64
14	100	68	104	68	108	68	112	70	118	70
15	98	70	98	72	102	72	104	72	112	74
16	100	70	100	74	100	74	104	74	98	70
17	112	64	112	64	118	64	120	70	120	70
18	98	64	98	64	102	70	112	70	124	70
19	102	70	108	74	108	74	110	74	112	78
20	94	60	100	64	108	68	120	70	124	74

GROUP C HEART RATE CHANGES

	base line	1st min	2nd min	5th min	10th min	15th min	20th min	25th min	30th min	40th min	50th min	60th min
1	82	80	78	64	64	62	62	60	62	60	64	68
2	84	84	80	70	64	62	62	58	58	54	64	68
3	74	74	72	64	62	62	54	54	52	56	58	58
4	72	72	74	62	66	62	60	62	64	62	62	64
5	78	74	72	64	64	62	64	64	62	60	64	64
6	92	84	72	70	68	68	64	68	68	72	72	78
7	84	82	74	72	74	72	74	78	77	72	73	74
8	81	80	74	66	64	62	56	58	62	62	61	60
9	78	74	64	66	67	68	67	68	70	68	65	66
10	64	62	54	52	50	52	52	54	54	51	52	52
11	60	60	54	54	52	54	56	60	56	56	58	62
12	72	72	70	68	66	67	68	68	66	66	68	70
13	98	94	70	72	72	74	74	66	72	72	78	78
14	68	64	64	62	58	58	54	56	58	58	54	56
15	70	70	78	56	54	56	54	54	58	60	65	64
16	54	54	52	50	50	52	52	60	54	56	58	58
17	64	62	62	60	60	56	58	58	54	52	54	56
18	98	92	84	76	64	65	64	62	58	64	64	62
19	62	62	60	58	54	56	54	52	50	54	56	58
20	77	74	62	62	64	64	56	58	57	58	64	64

GROUP D

NO.	NAME	AGE	GA wks	OC	IND	HT cms	WT Kg	SL 10th min	2% LIG ml
1	MAHESHWARI	32	38	G2P1L1	PREV CS	154	52	T4	0
2	UMA	28	38	G3P1L1A1	PREV CS	155	54	T4	0
3	VIDHYA	28	38	G2P1L1	PREV CS	160	54	T4	0
4	JAYASREE	21	38	G2P1L1	PREV CS	159	59	T4	0
5	AMBULI	28	38	G2P1L1	PREV CS	158	58	T4	0
6	SHENBAGAM	22	38	G2P1L1	PREV CS	162	53	T4	0
7	KAREENA	26	38	G3P2L1	PREV CS	160	56	T4	0
8	SUGANYA	22	38	G2P1L1	PREV CS	155	56	T4	0
9	DHANAM	27	38	G2P1L1	PREV CS	154	56	T4	0
10	PRIYADARSHINI	23	38	PRIMI	TWIN	150	54	T4	0
11	MARIAMMAL	22	38	G3P1L1A1	PREV CS	153	56	T4	0
12	KAVITHA	21	38	G2P1L1	PREV CS	154	57	T4	0
13	VELLATHAI	25	38	G2P1L1	PREV CS	154	54	T4	0
14	SILAMBARASI	25	38	G3P2L2	PREV CS	152	56	T4	0
15	PRIYA	23	38	G2P1L1	PREV CS	155	58	T4	0
16	VELANKANI	23	38	G2P1L1	PREV CS	156	52	T4	0
17	RAHIM BEEVI	25	38	G3P2L2	PREV CS	154	54	T4	0
18	MALLIGA	28	38	G3P2L2	PREV CS	154	56	T4	0
19	UMA MAHESHWARI	25	38	G2P1L1	PREV CS	157	56	T4	0
20	PRIYADARSHINI	30	38	G3P2L2	PREV CS	160	57	T4	0

NO.	NAME	EPH mg	COMP (D/NV/S)	OTHERS COMP	DUR min	MR (G/M/P)	NA 1st min	NA 5th min	PS (G/M/P)
1	MAHESHWARI	12			52	G	5	8	G
2	UMA	6			60	G	6	9	G
3	VIDHYA	12			62	G	5	9	G
4	JAYASREE	12	NV		62	G	6	9	G
5	AMBULI	12			64	G	6	9	G
6	SHENBAGAM	6			56	G	5	9	G
7	KAREENA	12			60	G	5	9	G
8	SUGANYA	18	NV		62	G	6	9	G
9	DHANAM	18	NV		56	G	5	8	G
10	PRIYADARSHINI	18	D/NV		70	G	5	8	G
11	MARIAMMAL	12	NV		52	G	5	8	G
12	KAVITHA	12			56	G	5	8	G
13	VELLATHAI	6			54	G	5	8	G
14	SILAMBARASI	18	NV		64	G	5	8	G
15	PRIYA	12			64	G	6	9	G
16	VELANKANI	12	NV		68	G	6	9	G
17	RAHIM BEEVI	12			52	G	6	8	G
18	MALLIGA	12			56	G	6	9	G
19	UMA MAHESHWARI	6			70	G	6	9	G
20	PRIYADARSHINI	6			62	G	5	9	G

GROUP D BLOOD PRESSURE CHANGES

	base sys	line dias	1st sys	min dias	2nd sys	min dias	5th sys	min dias	10th sys	min dias	15th sys	min dias	20th sys	min dias
1	124	82	124	82	124	82	82	64	84	64	92	64	94	68
2	114	80	114	80	114	80	102	68	94	68	84	64	94	70
3	112	70	112	70	112	70	86	56	98	56	102	56	84	54
4	130	84	130	84	132	84	104	64	88	64	98	70	84	60
5	132	82	132	82	132	82	110	78	102	74	86	58	84	58
6	124	80	124	80	122	80	94	70	84	68	94	68	94	68
7	128	84	128	84	124	84	102	70	86	64	114	72	110	70
8	104	70	104	70	120	70	78	56	82	56	80	56	94	58
9	104	74	104	74	108	74	90	60	84	56	82	54	88	56
10	124	78	124	78	124	78	104	70	98	68	84	62	82	62
11	126	74	126	74	126	74	108	70	84	60	94	62	94	62
12	116	78	116	78	118	78	78	54	82	56	102	70	102	70
13	122	82	122	82	122	82	84	64	108	70	108	70	104	70
14	118	74	118	74	120	74	102	70	78	56	82	58	94	54
15	116	78	116	78	118	78	102	70	94	70	86	64	82	64
16	108	72	108	72	108	72	78	50	82	54	98	70	98	70
17	122	74	122	74	124	74	80	56	84	56	98	70	98	70
18	116	78	116	78	116	78	102	64	82	60	82	60	94	60
19	104	74	104	74	108	74	84	60	94	62	94	62	94	64
20	130	84	130	84	132	84	80	56	102	60	102	68	112	70

	25th sys	min dias	30th sys	min dias	40th sys	min dias	50th sys	min dias	60th sys	min dias
1	98	70	98	70	102	70	108	70	120	74
2	`118	70	118	70	120	74	124	74	124	78
3	110	64	110	68	112	68	120	70	124	74
4	104	74	104	78	108	78	120	80	124	80
5	104	60	104	64	110	70	110	72	118	74
6	100	72	104	74	104	78	110	78	112	80
7	84	60	112	64	118	68	124	70	124	74
8	94	60	98	60	100	64	104	64	104	68
9	94	60	94	62	98	64	100	70	110	72
10	112	74	88	60	120	78	114	74	118	78
11	98	64	100	64	108	70	108	72	116	74
12	104	70	112	74	118	74	124	74	124	74
13	124	78	124	78	130	80	132	80	134	84
14	80	50	100	64	100	66	114	70	114	74
15	98	68	98	70	100	70	104	74	104	74
16	100	74	110	74	112	74	112	78	120	78
17	104	70	104	74	110	74	132	74	134	82
18	94	64	106	64	106	68	112	74	112	74
19	98	64	98	64	100	64	100	64	104	64
20	112	74	112	74	120	78	124	78	124	78

GROUP D HEART RATE CHANGES

	base line	1st min	2nd min	5th min	10th min	15th min	20th min	25th min	30th min	40th min	50th min	60th min
1	68	68	64	62	60	62	62	54	52	56	54	54
2	90	84	72	70	64	68	64	68	68	70	72	78
3	80	80	74	72	74	70	74	78	77	72	73	74
4	70	70	78	56	52	56	54	54	58	65	65	64
5	64	62	62	62	60	56	58	58	54	54	54	56
6	92	92	84	76	64	65	64	62	58	62	64	62
7	64	62	60	58	54	54	54	52	50	52	58	56
8	64	62	60	58	54	52	54	56	58	58	60	62
9	74	72	68	64	62	60	60	58	58	64	62	64
10	84	82	72	64	58	52	50	48	48	54	50	58
11	98	94	70	72	72	74	74	66	72	72	78	78
12	68	64	64	62	58	58	54	56	58	58	54	54
13	70	70	78	56	54	56	54	54	58	60	65	62
14	60	60	56	54	48	50	50	50	58	58	54	60
15	98	94	70	72	72	74	74	66	72	72	78	72
16	60	64	64	62	58	54	54	56	58	56	54	54
17	74	74	72	64	64	62	64	64	62	60	64	62
18	60	62	60	58	54	52	54	52	50	54	58	54
19	92	84	72	70	68	68	64	68	64	72	72	74
20	82	82	74	72	74	72	74	77	77	72	73	72